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A $660-Million Question p. 19

The T-38 Readies for Rollout p. 20

Lake Central—One With Problems p. 5

August 25, 1958

AMERICAN AVIATION

INTAKE TO THE FUTURE

Beyond this screen, which straightens turbulent air flows, Orenda can test run advanced engines in an atmosphere equivalent to 100,000 feet of altitude.

This new high altitude tunnel is another of the major programs at Orenda for research into air-breathing engines over the widest range of speed and altitude.

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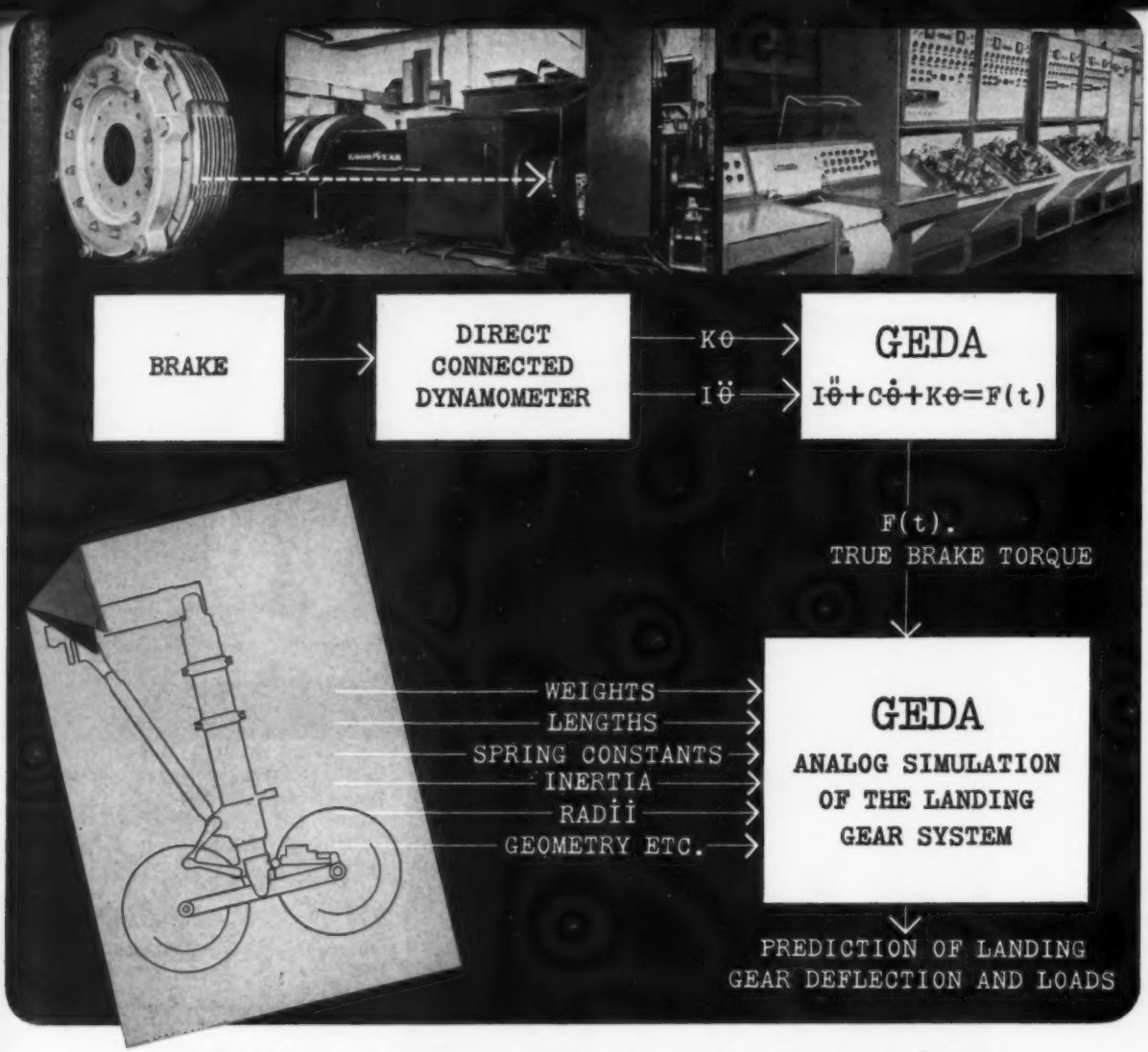

How Goodyear determines a vibration-free landing-gear system
—while the aircraft is still on "the boards!"

It's common knowledge that modern-day aircraft designers are turning to higher-strength alloys in landing-gear systems in order to save weight.

And it's a known fact, too, that landing gears made from these high-strength alloys are more flexible. But often it is not known, *in advance*, what the behavior of these components will be under aircraft braking conditions: whether vibrations will reach such amplitudes as to cause early fatigue, struts or other structures to fail, or in any way be unacceptable when the airplane is finally flown.

To determine this unknown, Goodyear engineers have applied the principles of vibration-dynamics, and together with an elaborate laboratory setup, Goodyear can now simulate a complete landing-gear system to predict the compatibility of all components before the gear has been built.

Teaming the proposed brake with a huge direct-drive dynamometer and an impressive lineup of GEDA Analog Computers, Goodyear can accurately ascertain the response of the landing-gear system to the brake—can investigate any desirable modifications while the system is still on "the boards."

This technology is solving knotty problems not only for jet fighters, but for complex truck or "bogie" type gears as well —at great savings in time and engineering man-hours. It is an example of how Goodyear serves its customers with advanced techniques as well as the finest hardware. For information, write: Goodyear, Aviation Products Division, Dept. T-1713, Akron 16, Ohio.

The Sound Answers come from **GOODYEAR**

AVIATION PRODUCTS

to implement your systems' engineering!

(TOP) U.S. Navy P2V Neptune
Distance record: 11,236 miles
October 1, 1946

(RIGHT) U.S. Air Force F-104 Starfighter
Altitude record: 91,249 feet
May 7, 1958

(BOTTOM) U.S. Air Force F-104 Starfighter
Speed record: 1,404 miles per hour
May 16, 1958

Only once in modern aviation history have *all three* major world records–for DISTANCE, ALTITUDE and SPEED–been held by the planes of *one* company. Lockheed achieved this triple triumph in 1958.

LOCKHEED means leadership

LOCKHEED AIRCRAFT CORPORATION, CALIFORNIA DIVISION: Burbank and Palmdale, California

JET FIGHTERS • JET TRAINERS • LUXURY AIRLINERS • PROP-JET TRANSPORTS • AIRBORNE EARLY-WARNING AIRCRAFT • ANTI-SUBMARINE PATROL PLANES

AMERICAN AVIATION

AUGUST 25, 1958—VOL. 22, No. 7

WORLD'S LARGEST AVIATION PUBLISHERS

Contents

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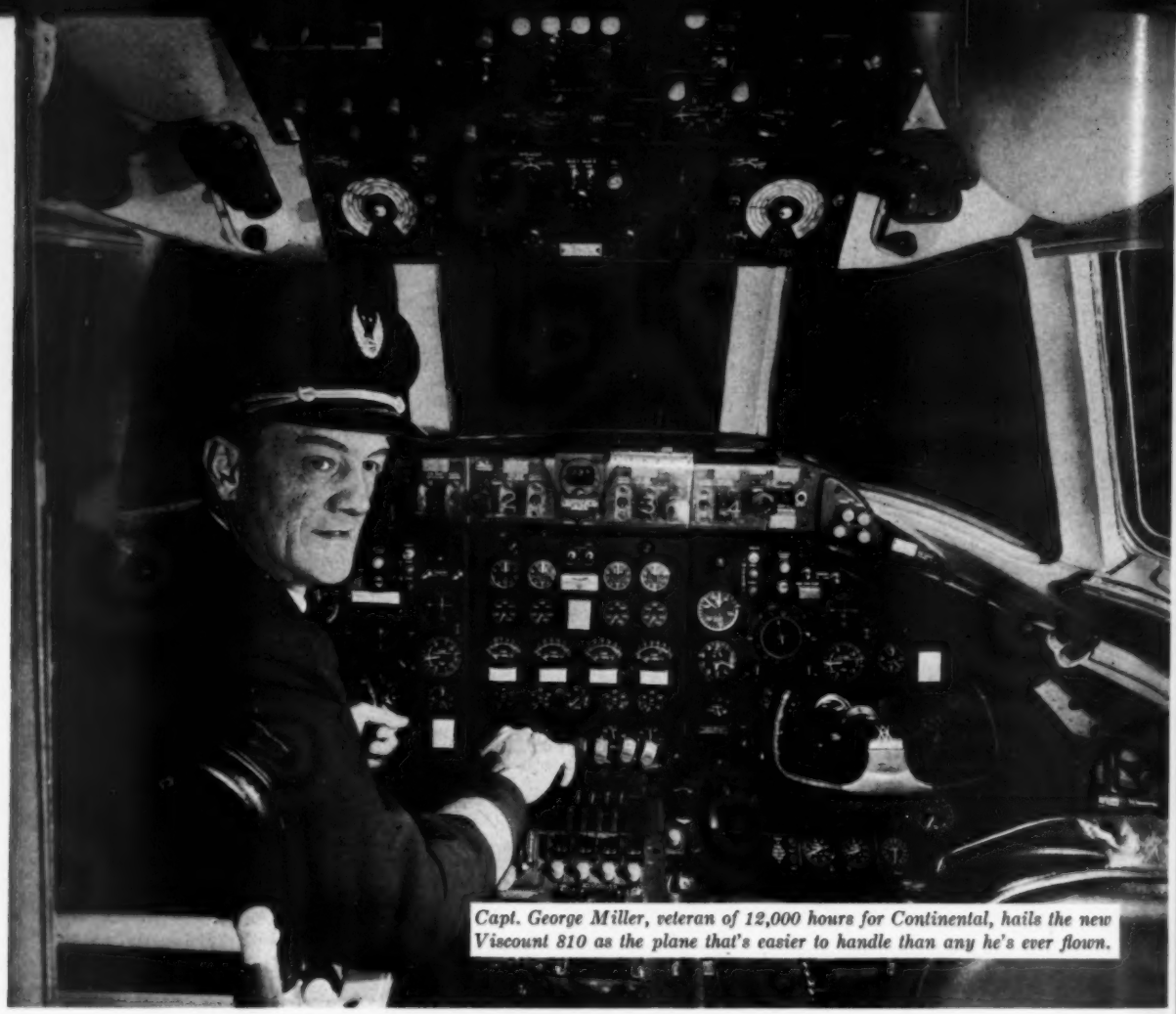

Capt. George Miller, veteran of 12,000 hours for Continental, hails the new Viscount 810 as the plane that's easier to handle than any he's ever flown.

FAST, SMOOTH, EASY TO HANDLE... CONTINENTAL'S NEW VISCOUNTS

"This new Viscount 810 handles like a dream", says Capt. George Miller, Chief Pilot for Continental Air Lines. "The Rolls-Royce Dart 525 jet-props are started by a fully automatic, timed cycle, simply by pushing a button and opening the fuel cock. These powerful engines require no warm-up or ground check. They can be opened up as soon as the ship is ready on the runway. Acceleration is smooth and fast. Control response is crisp. Take-off and climb performance are outstanding. The Viscount behaves beautifully at any altitude—and can be taken up to 30,000'. Stability is remarkable—even in turbulence.

"You can tell that pilots had a lot to do with the layout of this cockpit. It's been detail-designed with comfort and efficiency in mind. Window area is large, visibility excellent. Instruments and controls are grouped logically. The adjustable seats are especially comfortable. It all adds up to more enjoyable flying. This new jet-prop Viscount 810 is the best thing that's happened to pilots—and passengers—in many a year."

FROM THE WORLD LEADER IN JET-PROP AIRCRAFT...

VICKERS VISCOUNT 810/840

POWERED BY FOUR ROLLS-ROYCE DART ENGINES

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Did CAB Catch the Hint?

Fancy the dilemma created by a rich uncle who has long overstayed his visit in the family parlor. Everybody has something planned to do but nobody dares to tell the uncle to leave. Many subtle hints and much back-room whispering have gotten nowhere. Uncle just dallies and talks. After all, he not only holds the mortgage on the family manse but he might change his will if he's ushered out before he's quite ready to leave.

The White House was in somewhat the same spot with its Cherington-to-Quesada-to-Eisenhower-to-Congress report warning that unless the airlines can show greater earning capacity soon, the airlines and the aircraft industry and all of their suppliers are facing a serious financial crisis that could well affect the national economy during the shift from piston to jet equipment.

In the American government where the executive, legislative and judicial branches are constitutionally and otherwise jealous of their respective prerogatives and jurisdictions, it is not appropriate for the executive branch to dictate to a quasi-judicial agency such as the Civil Aeronautics Board which is responsive to Congress. It would be even more inappropriate for the executive branch to criticize directly the CAB lassitude in handling the airline industry's economic affairs.

So the White House tiptoed around the CAB by routing the Cherington report with all due formality to Congress, with the fond hope that Congress might then inform the CAB, all the while hoping that CAB might somehow hear about the report and even read it on the sly. The whole maneuver was so subtle that the nation's press didn't catch the pitch and even *The New York Times*, which has a difficult time anyway of elevating aviation above that of barge and tugboat news, ignored the Cherington report entirely.

It is just possible that the five members of the CAB have finally gotten hep to the report. If they've read it, they should have had some sleepless nights. For its impact is dynamic.

Problem A: How to swing the $2.8 billion airline investment in jets, and a gross piston-to-jet investment of $4 billion between now and 1962; and to avoid cancellations and serious consequences to the aircraft and engine companies and 5,000 other suppliers; and to provide the 80,000 to 125,000 new jobs which will be needed in a successful transition into the jet era.

Problem B: How to provide greater earning capacity for the airlines now without having to wait for the completion of the General Passenger Fare Investigation sometime next year, in order that the airlines can meet progress payments and move ahead with their commitments and instill some confidence in financial circles.

Solution A: The CAB could grant another across-the-board fare increase as an interim action pending completion of its long-range study, which increase would only then begin to bring airline fares up to the levels of other goods and services.

Solution B: Without disturbing the basic long-haul fare structure, the CAB could effect a 4% to 5% overall increase in revenues by approving the elimination of all discounts—military, round-trip, family plan, etc.,—and order the airlines to adjust to a 1958 pattern the antiquated DC-3 fare structure which unduly and unfairly favors short-haul stopover on long trips. In short, modernize and beef up the national fare structure without disturbing basic transcontinental fares.

Paul Cherington, one of the foremost experts in air transportation, and professor at Harvard Business School, has performed a major service with his report to the White House. A more detailed report is due soon. Presidential Aide Elwood Quesada did a smooth job of transmitting the report through channels. But has CAB taken the hint? That is the question. The next hint won't be so subtle. Unless CAB awakens to reality, drastic steps will be in order.

GE Makes the Grade

A new entrant into the U.S. commercial aircraft engine field is something of a major event.

Now that General Electric has clinched a substantial order for its CJ-805 fan-type jet engines to power the new Convair 600 ordered by American Airlines, it would seem to be quite clear that it has established a permanent beachhead.

GE's big Aircraft Gas Turbine Division at Cincinnati has been solidly set in the military market for some time. It has spent impressive sums on research and development with the aim of breaking through into the commercial field, not an easy thing to do. The first step came when its CJ-805 was chosen for the Convair 880, but now that American has selected the more powerful fan-type version for the promising new Convair 600, it has good reason to feel that it has made the grade.

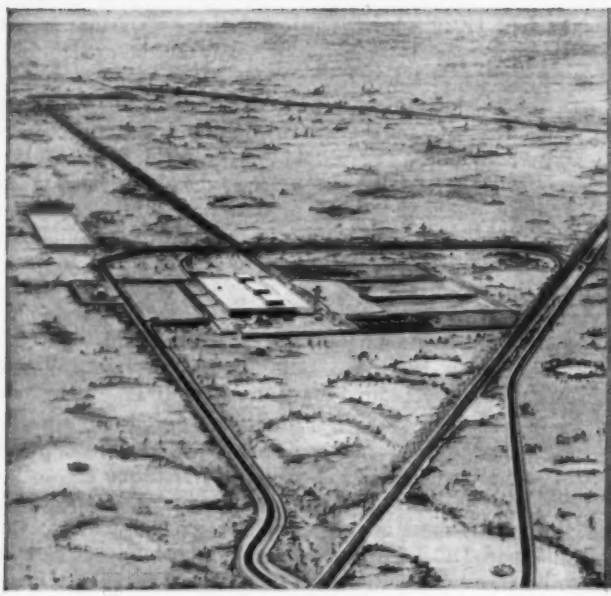
For most of the period of development and expansion of the U.S. commercial piston engines in higher power categories, the market was divided (and still is) between Pratt & Whitney and Wright Aeronautical. In the turboprop engine field (so long neglected because of lack of military interest), Allison Division of GM stepped to the front with orders for the Lockheed Electra, although it is a safe bet that Pratt & Whitney will also be a commercial supplier in due course with a turboprop.

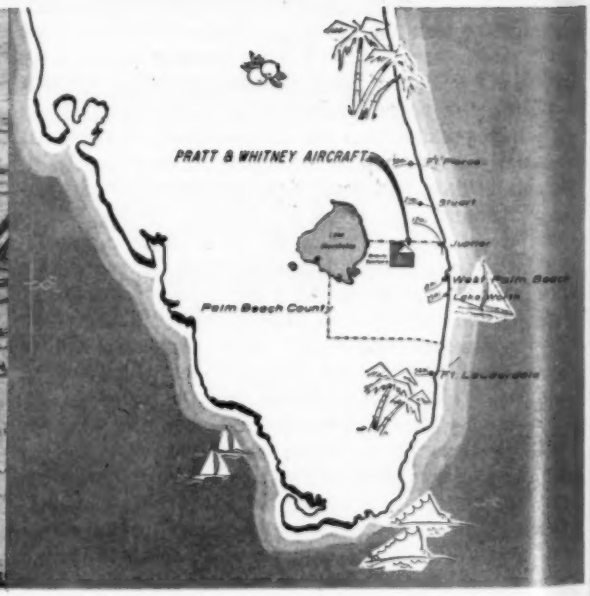
But Pratt & Whitney has had a clear field for commercial turbojets up to GE's successful link with the two Convair transports. Up to now, at least, Wright Aero hasn't penetrated the civil side with its jet engines.

It has been sort of a tradition, or custom, in the U.S. that there would be at least two major suppliers of aircraft engines in the higher power rating categories for both military and commercial customers. Pratt & Whitney is most assuredly well entrenched and has the 707 and DC-8 business. It would now appear that it will serve (and battle over) the commercial market with GE, which is in the field to stay. We think this will lead to healthy competition and sounder development in the best interests of U.S. aviation.

Wayne W. Parrish

FLORIDA RESEARCH AND





ISOLATION—Ten square miles comprise the site of Pratt & Whitney Aircraft's new Florida Research and Development Center. Experimental shops and offices covering some 17 acres are in the foreground, while the tests areas, barely visible in upper left, lie four miles in the background.

LOCATION—The new Center is located at United, Florida, midway between West Palm Beach and Lake Okeechobee, in the upper Everglades area. It is almost surrounded by a wildlife sanctuary. Most employees live in the cities and towns along the east coast of Florida, driving to the Center on excellent new highways.

DEVELOPMENT CENTER...

Another Unmatched Engineering Facility to Advance Propulsion Systems of the Future

Future aircraft and missiles may require propulsion systems far different from those in wide use today —different in size, power output, appearance and perhaps even in the basic method of utilizing energy.

To probe the propulsion future . . . and to build and test greatly advanced propulsion systems for coming generations of flight vehicles, Pratt & Whitney Aircraft is now operating its new Florida Research and Development Center. This facility supplements Pratt & Whitney's main research and development installations in Connecticut.

The new Florida Center, financed and built by Pratt & Whitney Aircraft, is unique in America's air industry. Here a completely air-conditioned plant with 17 acres under roof is specially designed and equipped for the development of new power plants of virtually any type. Testing is handled in special isolated areas; the nearest is four miles from the plant and many miles from any inhabited area. The new Center can be greatly expanded on its 10-square-mile site. Continued isolation is insured by a vast wildlife sanctuary in which the Center is located.

Today about 1800 people are employed at the Center, of whom about half are scientists, engineers and highly trained technicians. By late next year, a total of about 3500 employees is anticipated.

The new Florida Research and Development Center is one more reason why Pratt & Whitney Aircraft is able to continue producing the world's best aircraft propulsion systems . . . in whatever form they take.

Pratt & Whitney Aircraft

Division of United Aircraft Corporation

CONNECTICUT OPERATIONS—East Hartford.
Major Branch Plants—Meriden, Middletown, North Haven, Southington.
FLORIDA RESEARCH AND DEVELOPMENT CENTER—United, Florida.

LETTERS

A Bit Premature

In the June 30 issue of AMERICAN AVIATION, you made note of Turbo Dynamics' acquisition of airports at Minden, Nev., Fort Sumner, N.M., and Brooksville, Fla., and the fact that they are to be developed as industrial parks. We appreciate your interest as well as the space devoted to our endeavors but we must correct your statements regarding the Brooksville Airport. The facts are that the purchase of this site is as yet being negotiated and it has not yet become a Turbo Dynamics property. We hope to lend substance to your article as regards this item in the near future.

Bill R. Nash
Executive Vice President
Thomas Wilcox Associates, Inc.
Washington, D.C.

When & Where

AUGUST

National Flying Club Assn., annual convention, Hollywood Roosevelt Hotel, Hollywood, Calif., Aug. 25-27.

SEPTEMBER

SBAC annual flying display and exhibition, Farnborough, Hants, England, Sept. 1-7.

International Aviation Show, Coliseum, New York City, Sept. 6-14.

First International Congress of Aeronautical Sciences, Palace Hotel, Madrid, Sept. 8-13.

Air Cargo, Inc., air freight cartage conference, Hotel Sherman, Chicago, Sept. 9-10.

American Rocket Society, fall meeting, Hotel Statler, Detroit, Sept. 14-18.

American Petroleum Institute, Aviation Technical Service and Aviation Advisory Committee joint meeting, Melrose Hotel, Dallas, Sept. 15-17.

Instrument Society of America, annual instrument automation conference and exhibit, Convention Hall, Philadelphia, Sept. 15-19.

National Business Aircraft Assn., annual meeting Bellevue-Stratford Hotel, Philadelphia, Sept. 22-24.

National Assn. of State Aviation Officials, meeting, Bellevue-Stratford Hotel, Philadelphia, Sept. 24-26.

American Helicopter Society, annual western forum, Ambassador Hotel, Los Angeles, Sept. 25-27.

Air Force Assn., annual convention and airpower panorama, Dallas, Tex., Sept. 25-28.

SAE aeronautic meeting and aircraft production forum, Ambassador Hotel, Los Angeles, Sept. 29-Oct. 3.

OCTOBER

Champion Spark Plug Co.'s distributor and executive operators clinic, Secor Hotel, Toledo, Oct. 6-7.

Canadian Aeronautical Institute—IAS, joint meeting, Chateau Laurier, Ottawa, Oct. 7-8.

Champion Spark Plug Co.'s annual aviation spark plug and ignition conference, Secor Hotel, Toledo, Oct. 8-10.

Armour Research Foundation and Illinois Institute of Technology, annual noise abatement symposium, Hotel Sherman, Chicago, Oct. 9-10.

Air Mail Pioneers 40th anniversary Ball, Beverly Hilton Hotel, Beverly Hills, Calif., Oct. 11.

Annual New York State airport development and operations conference, Onondaga Hotel, Syracuse, N.Y., Oct. 14.

Annual Indiana aviation conference, Turkey Run State Park, Ind., Oct. 15-17.

Annual symposium on aviation medicine, Miramer Hotel, Santa Monica, Calif., Oct. 22-24.

IN BRIEF

Edited by Betty Oswald and Albert Bentz

Flight Engineers International Assn. has signed contracts with two more carriers—Seaboard & Western and Flying Tiger Line—with scope clauses possibly extending into turbine transport operations. Both are two-year agreements granting wage increases averaging nearly 10%. Although they apply to present piston operations they extend to August 1, 1960 and stipulate that flight engineers will be employed in any equipment used during effectiveness of contract.

Prototype of turboprop has gone to pasture. Lockheed's "old 1961," the first Constellation built during World War II was pickled for storage recently following its last test flight in the Electra engine test program. Originally a military C-69 for prototype Constellation development, it was sold as surplus to Hughes Aircraft after the war. In 1950 it was repurchased by Lockheed and "stretched" into a Super Constellation, then converted into a turboprop testbed in 1954.

Following the ground accident to the prototype Fairchild F-27, the wings and tail sections have been salvaged and mated to a new fuselage. The aircraft has been refitted with more powerful RDa7/2 engines and redesignated F-27A. Northern Consolidated Airlines' Friendships are being fitted with large cargo doors forward and are redesignated F-27B.

Air Force is on the spot to come up with a sure and permanent fix for Lockheed F-104, U.S.'s fastest and highest flying jet fighter. Although first corrective measures have been directed at J79 engine, it is becoming increasingly obvious that USAF, Lockheed and General Electric can ill-afford a subsequent grounding for other reasons whether they be engine, airplane or pilot handling. General press treatment of recent accident resulting in loss of research pilot Iven Kincheloe is keeping the F-104 in public's eye, promises to do so for some time to come unless USAF action is positive.

Grumman's re-entry into the commercial aviation market—after an absence of eight years—was marked by the successful first flight on Aug. 14. of its 370-mph Model 159 Gulfstream, 10-19 place, pressurized executive turboprop transport.

Northrop T-38 supersonic trainer probably won't fly until late this year. First General Electric J85 for the twin-jet is due to be delivered this month with a one-a-month schedule for the balance of the year. (See page 20.)

CAA airworthiness directive for inspection of DC-6 fin attach fittings appeared in the cards at presstime as National Airlines temporarily grounded its fleet of the Douglas transports. The problem: inspection of four aircraft revealed cracks in forward vertical stabilizer fittings. Douglas immediately recommended that carriers check aircraft with 33,000 or more flying hours.

Use of so-called "area-rule" aerodynamics in Convair 600s ordered by American Airlines will not only boost speed to 635 mph, but range also will be enhanced by utilizing four wing anti-shock bodies as fuel cells with a total capacity of 1,240 gals. This brings over-all Model 600 fuel load to 15,110 gals., enough to operate the jet on transcontinental nonstops at full cruise power. Area rule approach, in National Advisory Committee for Aeronautics achievement, pushes nearer to Mach 1, the speed at which jets can operate without encountering the sharp drag rise that causes their economy to deteriorate rapidly.

Can a player be a member of more than one team? Under the so-called "team concept" of procurement now being tried by the Air Force will team leaders holding prime contracts accept manufacturers as members if they have already signed up with a competing team no matter how desirable their equipment.

The question arose with the announcement that Goodyear Aircraft is a member of the Boeing and Martin-Bell teams for the development of the Dynasoar. It later developed that Goodyear is play-

ing two entirely different roles. In the case of Boeing it is making "pinpoint guidance" in one division, while in the case of Martin-Bell it is making escape capsules and airborne electronics—in two different divisions.

This raises the question of whether the Goodyear escape capsule might not, under different procurement techniques, have been accepted by both teams.

Convair has moved to cut red tape in piston transport spare parts service as it launches its all-out effort with models 880 and 600 jets. Example: it has notified customers to purchase directly from Hardman Tool & Engineering, Los Angeles, thereby reducing lead time on parts and replacements for proprietary seats on Convair 340s and 440s.

Unanswered demand for a small, rough-field shorthaul transport is luring new competitors into aircraft manufacturing. Most recent prospect: Emile Gilutin & Associates, Dallas, with its Model 101 Victoria four-engine turboprop powered by Lycoming T55s. Proposed model would gross 38,800 lbs. carry 40 passengers (8,000 lbs. payload) 600 nautical miles or 4,000 lbs, over range of 1,300 n.m. Cruise speed: 320 mph.

Gilutin and backers reportedly hold letters of intent for 11 aircraft, plan production of 175 aircraft selling at $500,000 each. Production is slated outside the U.S. to keep costs low, assuming necessary financial backing can be attracted to proceed. Principal sales targets are South American countries and U.S. local airlines.

Range warfare in jet sales is soaring gross weights beyond the 300,000 lb. mark. Close on the heels of Douglas offer of a 310,000 lb. DC-8, Boeing has jumped the top gross for its Intercontinental series 707 to a figure reportedly exceeding 310,000. Former high was 707—296,000 lbs.

Foreign transport sales can mean big business as evidenced by major decision of Canadair, Ltd. to manufacture its Napier Eland-powered Model 540 in a new plant near Sao Paulo, Brazil. Reportedly at stake are orders for 90 Cosmopolitans (valued at $100 million) over and above the 10 military-counterpart CL-66s to be built in Canada for the Royal Canadian Air Force. Brazil's Air Ministry has approved the undertaking and only the support of country's finance minister Lucas Lopes remains as an obstacle.

Air mobility is the key to United States capability of handling either a full-scale or or limited war, according to Lt. General James S. Gavin (U.S.A. ret.). In his book "War and Peace in the Space Age," Gen. Gavin reiterates his belief that the concept of the strategic bomber is vastly overrated and that the bomber will be the shortest-lived delivery system in history; however, air lift, light assault aircraft and helicopters will be necessary elements.

The current low estate of U.S. defenses is blamed by Gen. Gavin on the "misunderstanding" by President Eisenhower of the lessons of World War II and Korea and the unwillingness of former Defense Secretary Charles E. Wilson to listen to the requirements for surface strength.

U.S. airlines may be eclipsing the railroads in passenger transportation statistics but the No. 1 carrier (Pan American) still falls short of no fewer than seven railroads in total operating revenues. In a recent survey by Fortune magazine, here's how the carriers ranked among the top 50 U.S. transportation companies: PAA (8); American (9); United (12); TWA (15); Eastern (17); Capital (36); Northwest (42) and Delta (45).

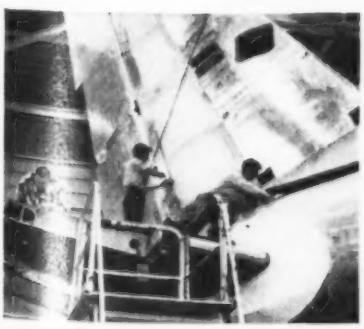
Passenger traffic in July was down from last year's figures, for the third straight month. The decline for July, however, was only .008%, less than that for May or June. Optimists read these figures as a sign of the beginning of the end of the general business recession. They point out that airlines were not affected by the recession as soon or as seriously as other industries and believe their recovery will be quicker and sooner than that of other industries.

Revenue passenger load factor in July was 59.75%, as compared with 65.14% in the corresponding month of 1957. The drop was not entirely due to the decline in traffic, however. Available seat-miles increased from 3.46 billion in July 1957 to 3.74 billion last month.

REPORT ON PRODUCTION

AHEAD-OF-SCHEDULE production of Boeing 707 jetliners reflects the efficient manufacturing techniques developed by Boeing while producing more than 1600 large multi-jet aircraft ... more than any other company in the world. Boeing methods, superior design experience and new facilities combine to produce outstanding jet aircraft. Boeing KC-135 jet transport-tankers, built in this same plant, are setting Air Force records for minimum maintenance and maximum reliability.

SUB-ASSEMBLIES completed in a huge new Transport Division facility are fed into final assembly area. In every phase of production, unyielding standards of quality control are adhered to rigidly. Incorporated in the 707, and the shorter-range 720, are all the benefits of Boeing's 10 years of multi-jet production experience.



INFINITE CARE assures assembly and production at the same high level as advanced Boeing design. Every step, every detail, is checked, double-checked, and checked again.

SLEEK 707s ROLL OUT AHEAD OF SCHEDULE. Within months they'll enter commercial service. By that time, Boeing multi-jet transport-type aircraft will have logged more than 200,000 hours of flight experience. The 707 and the 720 will provide airlines with a family of jetliners loaded with passenger appeal, and designed and built for profitable operations on short, medium and long-range routes.

These airlines already have ordered models of the Boeing family of jetliners:
AIR FRANCE • AIR INDIA • AMERICAN • B.O.A.C. • BRANIFF • CONTINENTAL • CUBANA
LUFTHANSA • PAN AMERICAN • QANTAS • SABENA • SOUTH AFRICAN • TWA • UNITED • VARIG

BOEING
Family of jet airliners

AIRTRENDS

Edited by Elizabeth Oswald and Albert Bentz

Air Force is cracking down on near-miss incidents as a result of a "significant number" of near-collisions being reported daily to USAF headquarters. Gen. Thomas D. White, chief of staff, has ordered base commanders to establish local flying area boundaries—a safe distance from airways—and to see to it that pilots under their command as well as civil and CAA authorities are familiar with the boundaries. Order was issued in a "Special Subject for Inspection" and admonishes commanders and their inspectors to take "whatever other actions" are necessary to minimize probability of mid-air collisions.

B-70 will be speeded on the theory that a Mach 3 aircraft operating from advanced bases could reach any target in 29 minutes. This would prevent an enemy from launching more than one ICBM aimed at the U.S. since such bombers would be destroying launching pads before the first missile hit. Hope is for an operational aircraft by 1964 or sooner if satisfactory materials and engines can be produced in time.

Explosive forming of metal could provide answers for the development of new and advanced aircraft. A number of airplane companies are working on the new technique with the feeling strong that the process will be good only for parts which won't be produced in great quantity. Forgings, extrusions and other processes will be used for quantity production.

North American's A3J Vigilante will fly at Columbus, Ohio before the end of August. Scheduled in limited numbers for the Navy, Air Force is reportedly "interested" but doesn't have the money to buy the aircraft which carries a substantial amount of AF-developed equipment.

Army apparently has switched its aviation emphasis to its transportation corps. Brig. Gen. Richard D. Meyer, recently named deputy chief of transportation for aviation (AMERICAN AVIATION, Aug. 11, p. 15), has been given responsibility for "all research, development, procurement and maintenance phases of the rapidly expanding Army Aviation program." Meyer, a logistics expert, is an instrument pilot.

Beryllium is the white hope of the Air Force in battle to solve high temperature and weight problems involving such aircraft as the B-70 and the F-108 and weapon systems still over the horizon. The metal, which holds its strength at temperatures in excess of 1,600°F, is not only tricky to handle but is extremely toxic in its pure form. Manufacturing process studies are under way. AF hopes are partially based on the experience with solving the knotty problems involved in the use of titanium.

Negotiations for the merger of Northrop Aircraft Inc. and American Bosch Arma are progressing favorably. No decision has been yet made nor is one likely now for some weeks.

Chance Vought is making a new bid for Navy ASW contracts. Company has established an antisubmarine warfare engineering task force made up of 50 engineers, later to be expanded to 200. Seven groups are in the force: systems analysis, detection, missiles, aircraft, R&D, nuclear propulsion and military liaison. One of its big jobs will be to design "new and better types of carrier-based ASW airplanes." Lockheed and Grumman now are principal ASW contractors for Navy.

Question still isn't settled on timing of decision of the UCX (utility cargo) off-the-shelf Air Force competition. Lockheed is, of course, flying its entry, the JetStar, with the McDonnell entry not yet ready for flight. Lockheed estimates the cost of the AF version of the JetStar at just under $500,000 with powerplant—either two- or four-engine version extra. Amount of government-furnished aircraft equipment might reduce the bill somewhat. The government price compares with figures of about $800,000 plus an additional $200,000, give or take a little for the engines for commercial aircraft.

Major question at Fairchild is whether the Air Force will buy the F-27. AF has money for airlift but money for the F-27 added

in the Senate was eliminated by the House-Senate Conference Committee before final passage of the Defense Department's Appropriation Bill.

Lt. Gen. James H. Doolittle (USAF ret.) will become chairman of the board of directors of Space Technology Laboratories Jan. 1. STL is now a division of Ramo-Wooldridge Corp., but becomes a separate corporation after year-end. Doolittle is now v. p. of Shell Oil Co. He will continue as a member of the Shell board. He also is chairman of NACA and of USAF's Scientific Advisory Board.

Unprecedentedly long initial overhaul life of 1,000 hours for the Rolls-Royce Avon RA.29 10,500-lbs. thrust turbojet engine has been authorized by Britain's Air Registration Board.

This is twice the life which the company targeted for the engine, power unit of the de Havilland Comet 4 and Sud Aviation's Caravelle, soon to go into scheduled airline service.

Proving exercises leading to the achievement involved four RA.29s which accumulated 7,000 hours flying time. During this period, only one premature engine removal was experienced, and this was due to failure of an accessory.

Another turbojet engine which is off to a good start is General Electric's 10,000-lbs. thrust CJ-805. This engine, slated to power the Convair 880 jet transport, has passed CAA 150-hour qualification testing.

There's still a bit of mopping-up ahead prior to CAA certification. For example, ability of the engine to operate under icing conditions must be demonstrated. Also, the company must show a satisfactory turbine wheel over-strength margin. However, G.E. expects to have the engine certificated next month, in which case performance details will be released in December.

By the time the CJ-805 sees service with the airlines, it's expected that the high thrust/weight ratio engine will have demonstrated enough reliability in flight tests, etc. to warrant authorization of a very acceptable overhaul life.

GE is reportedly having trouble meeting its 2,500-lb. thrust specifications on the J85 and Fairchild is having its own troubles with the J83. Major question now is: "How long will the Air Force carry along the parallel development of both the J83 and J85?" Announced policy is to standardize on one engine. Pressure exists to keep both programs going until the engine manufacturers eliminate bugs, inevitable in all new engine developments, and full advantage is taken of what is considered a "major breakthrough" in turbojet development.

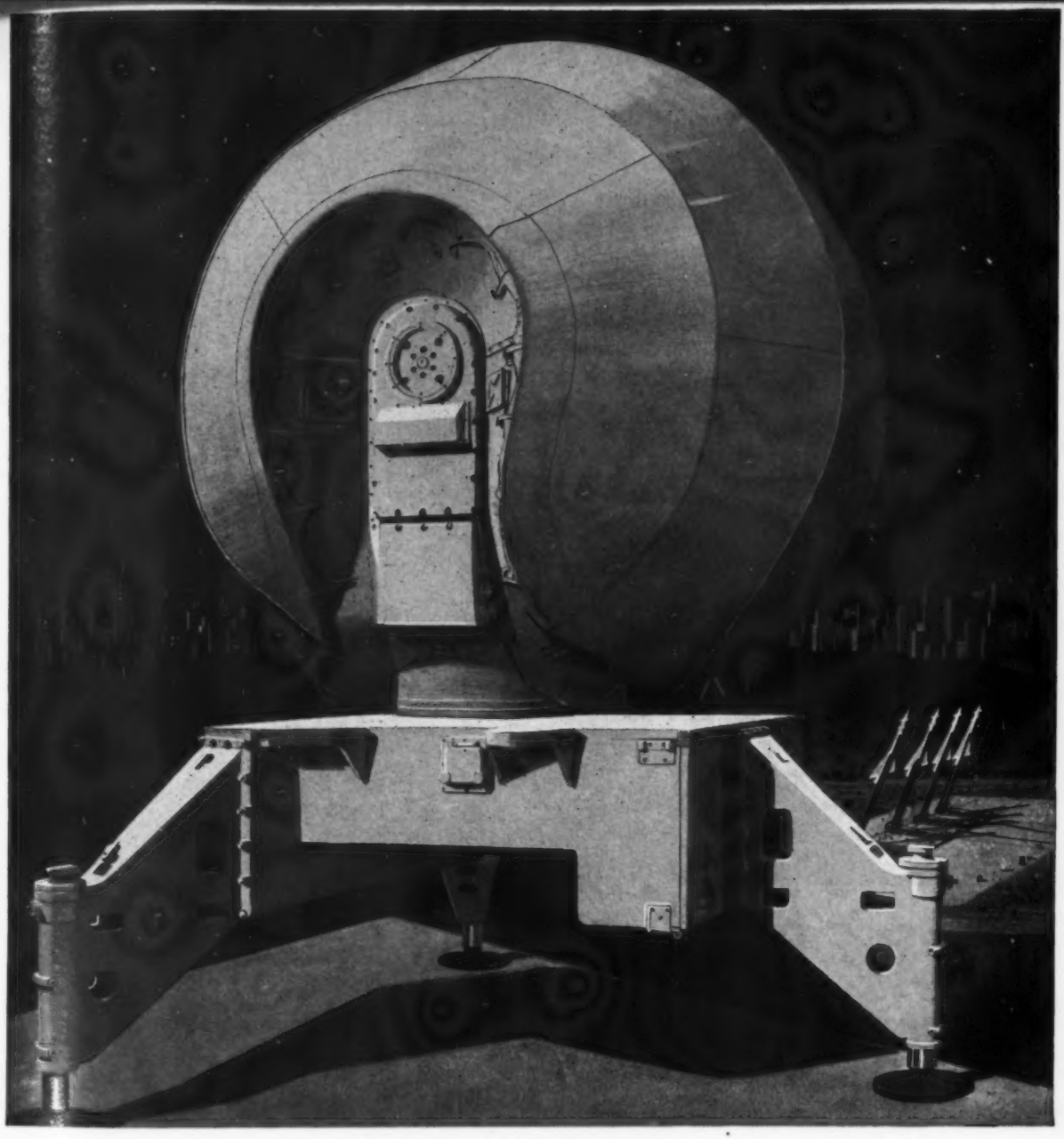
A watered down version of HR 8002, the so-called accrued expenditure bill, was enacted after a bitter controversy in the House. Exactly what the bill means or how it will be administered isn't at all clear.

The bill means something—or nothing, depending on who is talking. Originally sponsored by the Hoover Commission, in theory at least, it was designed to give both the Bureau of the Budget and the Congress better control of the expenditure rate.

What the bill does, as passed, is to recognize the trend, which had already started, of controlling the rate of expenditures rather than the rate of government obligations. How it will be used depends on the White House and the mood of the Congress when it considers the next budget.

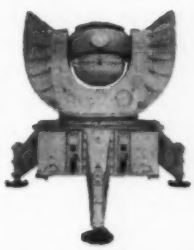
Pratt & Whitney will deliver two JT 12, 2,900-lb. thrust engines to Lockheed-Marietta probably in October. The engines will be used in a test program which calls for installation in a single pod on one side of the JetStar and balanced with an Orpheus engine on the other. Seemingly, if the test program goes well, Pratt & Whitney will move almost automatically into the forefront of the competitive battle for small high thrust-to-weight turbojets.

Wait 'til next year is the Navy's word to contract maintenance firms eyeing a bigger share of BuAer business. Navy renews its maintenance contracts every three years and expects to increase to about 33% its share going to private firms compared with 25% during past three years.



big ears of Nike Hercules

Mounts for radar antennae used by the U. S. Army's Nike Hercules to track aerial intruders and guide the deadly Nike missiles that strike them from the sky are products of the integrated manufacturing and engineering skills of Kelsey-Hayes, working in close cooperation with Western Electric. Capabilities range from prototyping to final production. The Speco Division is one of seven Kelsey-Hayes Divisions devoted to the production of aircraft and missile components.
Kelsey-Hayes Company, General Offices: Detroit 32, Michigan.



Nike Antenna Mount produced by Speco Division of Kelsey-Hayes requires over 2,000 individual parts, many of which are machined to a tolerance of less than two ten-thousandths of an inch.

KELSEY-HAYES

KH

AVIATION DIVISIONS, KELSEY-HAYES CO., DETROIT 32, MICHIGAN

18 PLANTS: Detroit and Jackson, Michigan; Los Angeles; McKeesport, Pa.; Springfield, Ohio (Speco Division); Utica, New York (Utica Drop Forge & Tool Division); Davenport, Iowa (Farm Implement and Wheel Division); Philadelphia (Heintz Division); Clark, New Jersey (New Jersey Division); Windsor, Ontario, Canada.

New B. F. Goodrich Liquid-Cooled Brake solves aviation's hot landing problem

HERE'S a revolutionary new braking system developed by B. F. Goodrich that absorbs millions of foot-pounds of energy—yet stays cool enough to touch. This is the first and only proved Liquid-Cooled braking system designed specifically to handle the higher energy conditions of jet aircraft today and in the future.

In the B. F. Goodrich Liquid-Cooled Brake, a coolant fluid circulates behind the friction surfaces, absorbs heat and carries it to a heat exchanger where it is safely dissipated at low temperatures. Excessive heat build-up within the wheel and brake area is eliminated. Friction surfaces maintain their normal stopping characteristics at all times.

During recent flight tests on the Boeing 707 prototype, including repeated taxi tests and power drag, the B.F.Goodrich Liquid-Cooled Brake operated consistently at maximum temperatures well below 500° F—compared with 1500-2000° F for conventional brakes. No cool-off periods were necessary. Even after a stop where maximum braking was applied for highest rate of deceleration, crew members were able to rest their hands on the brakes without discomfort. The brakes were exceptionally smooth and positive—no fade, no noise, chatter or sparks.

B. F. Goodrich engineers are ready to work with you in designing the new Liquid-Cooled Brake system into your high-performance aircraft—without a weight penalty. Write B. F. Goodrich Aviation Products, a division of The B. F. Goodrich Company, Troy, Ohio.

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AMERICAN AVIATION

AUGUST 25, 1958—VOL. 22, NO. 7

WORLD'S LARGEST AVIATION PUBLISHERS

Used Aircraft—$660-Million Question

- **Who'll buy 600, $1.1-million piston planes?**
- **Maybe foreign markets, but are there dollars?**
- **What happens as the used-plane market declines?**

By Albert W. Bentz
Manufacturing-Military Editor

The airline and airframe industries are face to face with an equipment dilemma of rather fantastic proportions: What to do with 600 or more surplus piston-powered aircraft when the turbines arrive.

This is not something far into the future. It is just around the corner.

Unofficial estimates have placed the probable surplus of conventional aircraft variously from as low as 300 to more than 600. These figures, however, appear to be on the conservative side. Here's why:

American Airlines, for instance, has ordered 110 jets and turboprops. It plans to dispose of most of its fleet of piston-powered aircraft, retaining only 15 to 25 by 1962. Its present fleet is right at 200. If it dropped only 150 of these, it would mean that 110 turbines will replace 150 piston-type planes—a ratio of 11 to 15. U.S. carriers have some 500 turbines on order. An extrapolation of the American ratio shows a possible surplus of piston-powered aircraft in excess of 680.

Even if there are only 300, the problem is one of considerable magnitude because many of these will be big DC-6/7 and Constellation types, some of which went on the books originally at $2.5 million per copy.

• **Cherington report spots problem**—The situation is as tough for the manufacturer of jets as it is for the airlines. The Cherington report, released earlier this month, pointed out:

"As the competitive race for aircraft sales tightens, in the effort of each manufacturer to approach his break-even point, increasing pressure is being brought on the manufacturers to give more favorable terms to the airlines. Thus, several of the manufacturers have recently agreed to take in trade certain older aircraft for new aircraft. This, in effect, transfers the surplus aircraft disposition problem from the airlines to the manufacturers along with any risk that the old aircraft cannot be sold at the trade-in price."

There have been a number of possible solutions advanced, but no one at this time is willing to guess on the outcome. There are markets for the planes, but sales potential for so many planes is extremely dubious.

Here are some of the markets most often mentioned:

- Foreign carriers with dollar credit that will continue to use piston-powered equipment on their domestic routes.
- Foreign countries in the soft currency category that do not now have airlines or have inadequately equipped carriers.
- Supplemental carriers in this country.
- Local service carriers that can use some of the Martins and Convairs, possibly some DC-6s and Connies.
- The executive and business market.

There also is the possibility that some of the aircraft will be converted to turboprops and their use extended with the major domestic airlines.

• **They'd like to buy, but**—There are some very good possibilities overseas, but the big problem is finance. For instance, there is a really large market in the undeveloped areas of South America, where there are few roads, few railroads. B-17s, Condors, PBYs etc. now are used for air transport. Southeast Asia, Africa and Australia also have been cited as good potential markets.

But the question is how can South American, African and Asiatic countries in the soft currency (non-dollar and non-sterling) category buy dollar-priced aircraft, particularly in the million-dollar-per-copy bracket?

Best answers appear to lie within the U.S. federal agencies—the Export-Import Bank, Development Loan Fund, International Cooperation Administration, etc. Another possibility is the establishment of an international bank in South America. A third possibility would be for the government to underwrite loans made to these buyers by private banks.

The Ex-Im Bank is taking a long, hard look at the problem, but has told AMERICAN AVIATION it is unlikely any policy action will be taken until a test case is presented by a manufacturer. Problem is that Ex-Im Bank was set up to assist U.S. manufacturers to sell new goods abroad. Indications are that it may require that the piston-powered transports be "cranked back" to zero time and have manufacturer warrantees before it will participate.

Another problem is that the bank will participate only to the extent of 60%, requiring that the manufacturer get a 20% down payment from the customer and then himself hold one-fourth of the remaining 80% of the loan.

• **Fund could use more funds**—The Development Loan Fund, set up this year by act of Congress to assist backward countries, is hampered by lack of funds. Its allocation amounted to only $300 million and it reportedly already has loan requests exceeding a billion dollars annually. However, an official of the Fund said DLF is interested in the aviation problem, but he added it necessarily would have to have a low priority at present.

In practice, the DLF probably would be buying the aircraft for dollars and selling to the soft currency countries for local money. It would become virtually a gift from the U.S. government and, as one observer pointed out, "there are a lot of our own airlines who would like to have gifts of aircraft."

The Cherington report took cognizance of the disposal problem and pointed out that there is a "considerable market" overseas. It cited the reluctance of Ex-Im Bank and DLF to make loans on second-hand aircraft and suggested that the Air Coordinating Committee or the Operations Coordinating Board "would be appropriate avenues by which policies involved in this problem might be raised and examined in greater detail with the agencies concerned."

An aircraft industry spokesman pointed out that export financing of the surplus aircraft would have world-

. . . The $660-million question

wide beneficial "poltico-economic" effects, particularly since the Russians are entering with their jet transports.

J. D. Ahlers of Lund Aviation, Inc., New York, has prepared a searching analysis of the surplus aircraft picture and concludes that it is up to the aviation industry to prevail upon government agencies to assist in financing sales to foreign airlines, which he believes to be the best available market.

He says U.S. support could take two forms:

1. Underwrite loans made by private banking firms;

2. Make loans through existing government agencies to the foreign carriers. He points out that assistance now will "save the federal government much greater expense later."

Ahlers, who estimates there will be 600 used transports available, makes a strong point against cranking them back to "like new" condition. "What most foreign airlines need in a used airplane," he says, "is not remanufacturing but conversion."

There has been some hint that manufacturers themselves might be going into the used airplane business, setting up their own system of selling and financing them.

In some instances, manufacturers are finding themselves on the spot. They either have to take trade-ins or lose some of the orders for jets they have on the books. It's a matter of economics as far as the airlines are concerned. There has been no hint as to what kind of penalties an airline would have to pay for canceling an order. But the threat of cancellation is there.

• **Used aircraft prices still declining**—All of this has contributed to the continued decline in prices of used aircraft. Capital Airlines, as an example, recently had a starting price on Lockheed 049s of $1.2 million; this dropped to $900,000 and finally to any price that they would sell for.

DC-3s, which 18 months ago were selling for $125,000, are now in the $40,000 bracket, and a large group is expected to come on the market with the transition to jets. There still will be a lot of DC-3s around standing alongside the jets in the coming turbine era, according to most observers.

The C-46 market is in the same situation. The Air Force could clobber this market if it turns loose the 200 C-46s it has as surplus. These are being held, but can't be held indefinitely.

The big hooker is going to be getting rid of the $2-million DC-7s and Super Constellations.

The U.S. situation is further complicated by the fact that foreign carriers also have some 450 jets and turboprops on order, which will mean a major retrenchment in their piston-powered fleets. This is a particularly serious problem from the American standpoint, since the foreign countries, in many cases, can get rid of their conventional aircraft on better terms to the soft currency countries than we presently can make.

There is another threat, too. Many foreign carriers have ordered U.S. jets and turboprops. Some want to trade in their present equipment on the turbines. If they can't, there may be cancellations. This could throw more business to foreign manufacturers, which not only would cut the American production economy but further cloud the used-plane market with competition from sources that could offer easier credit terms.

Whatever the answers, they will have to be found soon, since the turboprops already are flying and the jets will start on U.S. routes later this year.

The Used-Aircraft Situation

The Markets	The Problem	The Solution?
Foreign carriers	Finance	Liberalizing U.S. credit policies to foreign borrowers
Supplemental carriers	Uncertain status	CAB could clarify
Local airlines	Finances, need for more efficient aircraft	More imaginative conversion designs
Corporation aircraft	A limited market	A major sales effort
Conversion to turboprops	Cost	Manufacturer financing of prototype conversion, such as Eland-Convair that led to Canadair CL-66

The T-38 Rolls Out

AF's first supersonic trainer is designed for the future

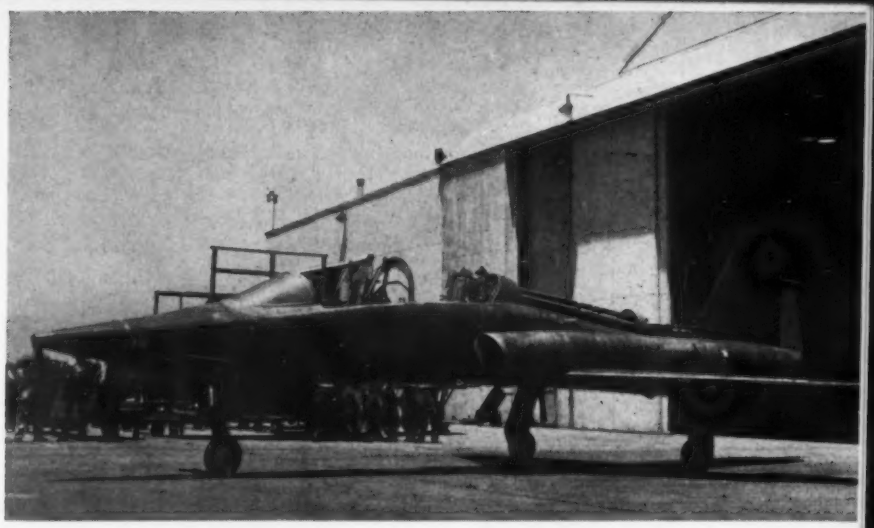
Another milestone in aircraft development will be reached with the delivery of the T-38 to the Air Training Command—probably in 1960.

The plane, according to Northrop Aircraft, Inc., its producer, represents a wedding of economy of operation and high performance. The system is made possible by the development of the new lightweight, high-thrust-to-weight ratio engines of the Fairchild J83, General Electric J85 and Pratt & Whitney JT12 type. Initially, the T-38 will be powered by two non-afterburning GE J85 turbojet engines rated at 2,000 lbs. thrust (approx.) each. Later, 2,500-lb. thrust afterburning J85s will be installed.

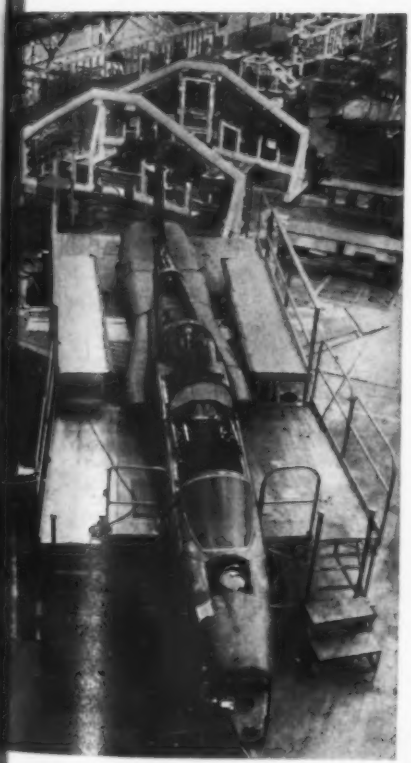
The plane is a two-place aircraft with the instructor sitting behind the student in a slightly raised position to provide maximum visibility. Safety has been provided with the placing of all instruments in front of both the pilot and the instructor. Some of the weight advantages were sacrificed in order to provide a wider than usual cockpit and the safety of two engines.

Maintenance and operating costs will be held to a minimum, according to the manufacturer, for a number of reasons. First, the new lightweight engines will reduce fuel costs while providing supersonic speeds and advanced training. Second, it will provide easier maintenance by means of ready accessibility—particularly to the electronic and other gear in the nose of the aircraft. Finally, versatility permits the use of the aircraft for training in all-weather navigation over long distances and, the simulation of the approach characteristics of such aircraft as the B-58, the Century Series fighters and the B-70.

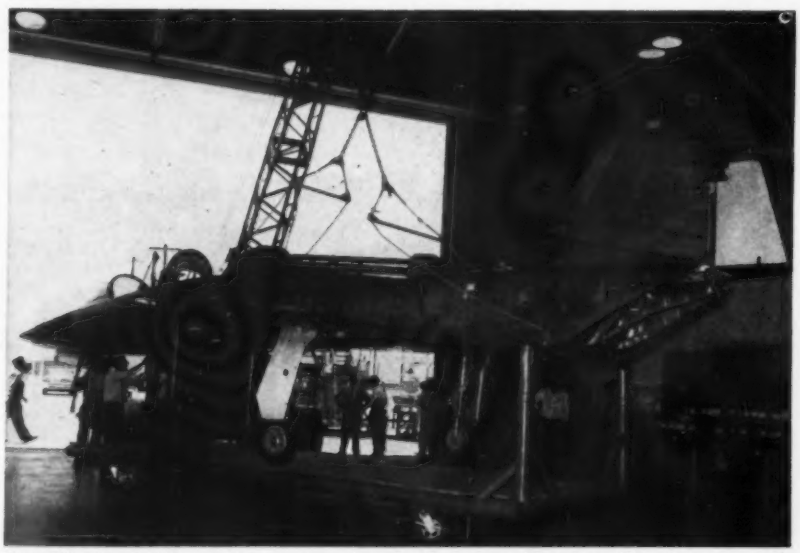
FORWARD FUSELAGE TEST UNIT of the T-38, like all parts of the aircraft, spent long hours in the low-speed wind tunnel.



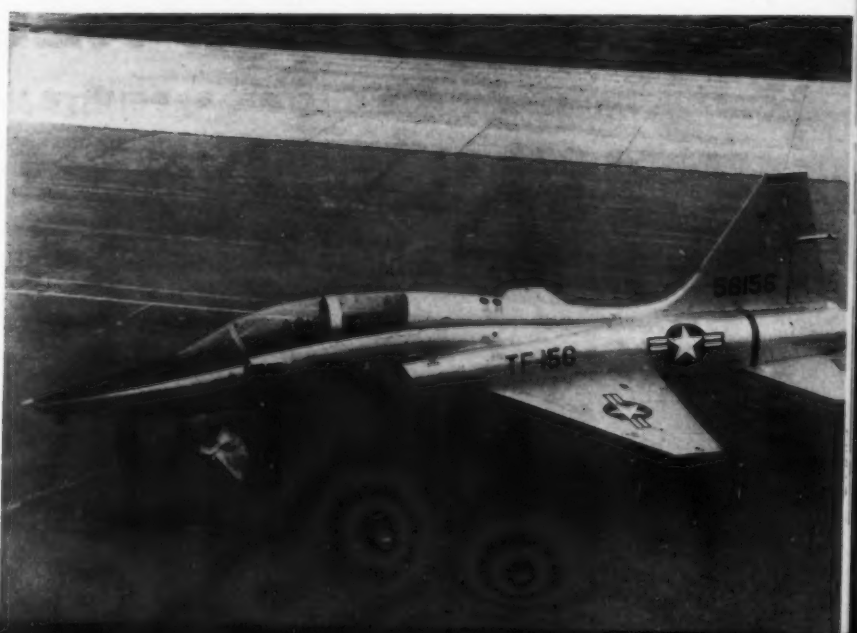
EASE OF MAINTENANCE is featured throughout the T-38. Access to electronic packages and other gear in the nose compartment is provided by large, removable panels.



"COKE BOTTLE" SHAPE and big air inlets for its J85s have been acquired. These features reduce drag and insure maximum performance of the new lightweight, high trust/weight ratio engines.



READY TO ROLL on its own legs for the first time, Prototype No. 1 is removed from the portable final assembly fixture.

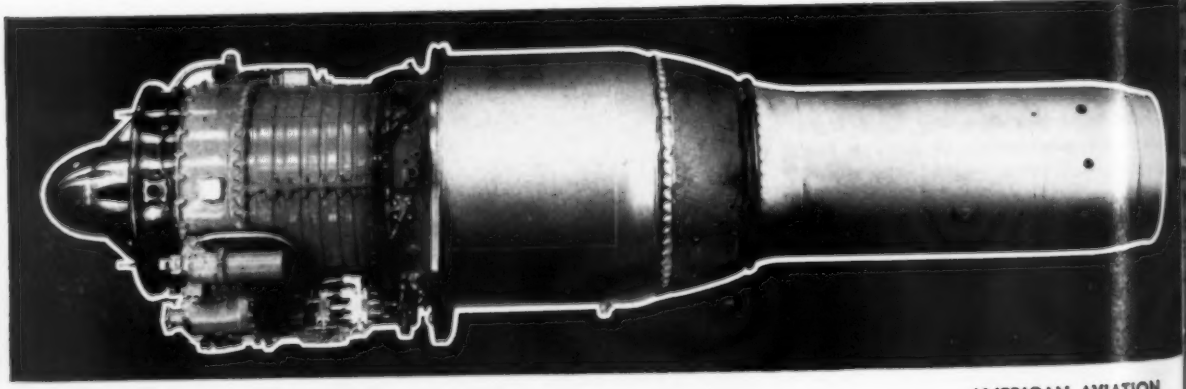


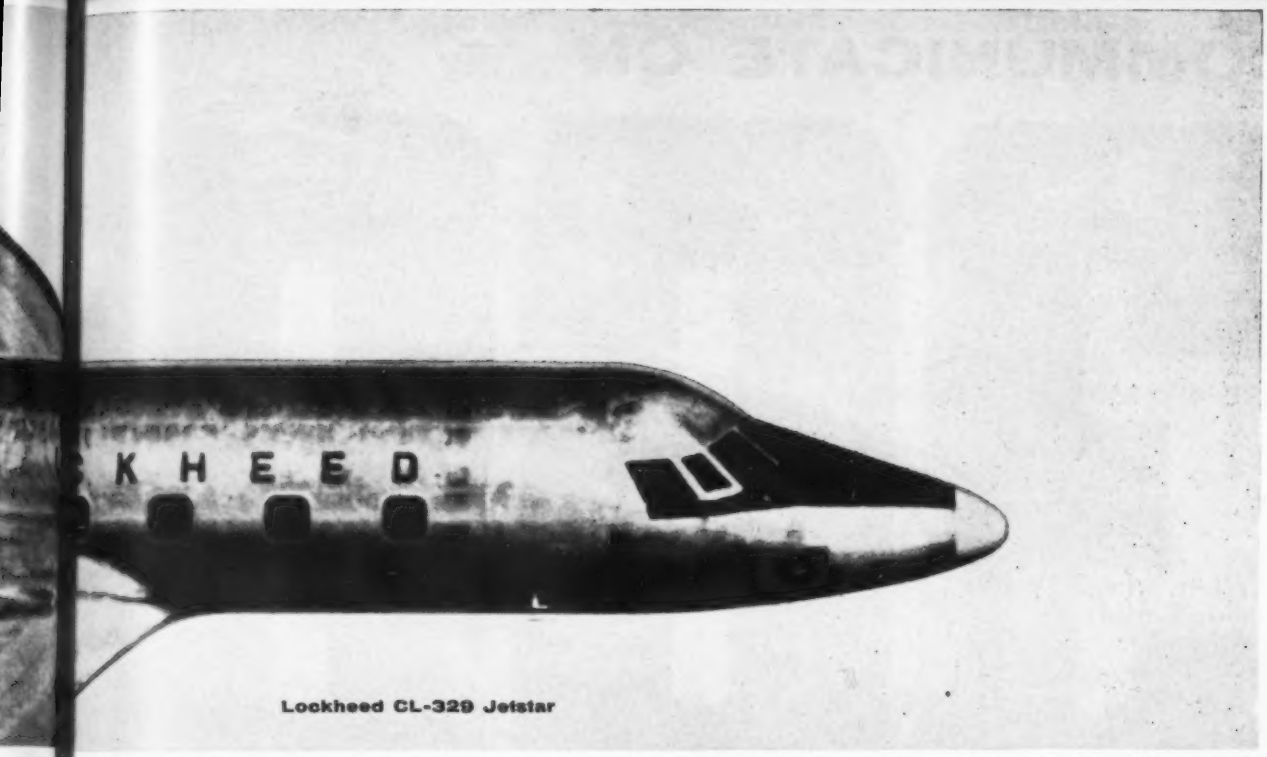
MOCKUP of the Northrop T-38, the Air Force's advanced, supersonic trainer, which rolled out at Hawthorne, Calif., August 15. First flight is scheduled to take place about the year end.

→

WORLD'S DESIGNERS SPECIFY **ORPHEUS** POWER

in fighters, strike aircraft, executive transports, and trainers





Lockheed CL-329 Jetstar

Folland Gnat

Dassault Etendard VI

Orpheus-powered Jetstar circuits the States on 4-hour demonstration flight

aking off from Edwards Air Force e in California, the prototype pheus/Jetstar touched down in shington, then in Massachusetts and rida. Only 18 hours after leaving wards, the Jetstar returned to base. had completed its round tour in hours flying time at an average mph.

The current Orpheus 3 is rated at 50 lb and has the outstanding ust/weight ratio of almost 6:1. The pheus 4, the trainer version, is rated 4,230-lb thrust; it is designed for lowest possible fuel consumption long overhaul life.

Dimensions Orpheus 3: Length 5 in; Diameter 32.4 in.

MOST ADVANCED TURBOJET IN ITS CLASS

Orpheus development continues. The latest version, the Orpheus 12, has a still higher power/weight ratio, giving 6,810-lb thrust dry, over 8,000-lb with Bristol simplified reheat.

Versions of the Orpheus power—or are specified for—the following aircraft:—

Lightweight fighters/strike aircraft

Folland Gnat	UK, INDIA, FINLAND
Fiat G 91	ITALY
Dassault Etendard VI	FRANCE
Breguet 1001 Taon	FRANCE
Hispano HA 300	SPAIN
Aerfer Leone	ITALY
Dassault Etendard IV (alternative engine)	FRANCE
Sud Aviation Baroudeur (alternative engine)	FRANCE

Executive transport/ crew-readiness trainer

Lockheed CL-329 Jetstar*	US

Trainers

Folland Gnat Trainer	UK
Fuji TIF 2	JAPAN
Fiat G 91 T	ITALY
North American Model 249 (alternative engine)*	US

Research Aircraft

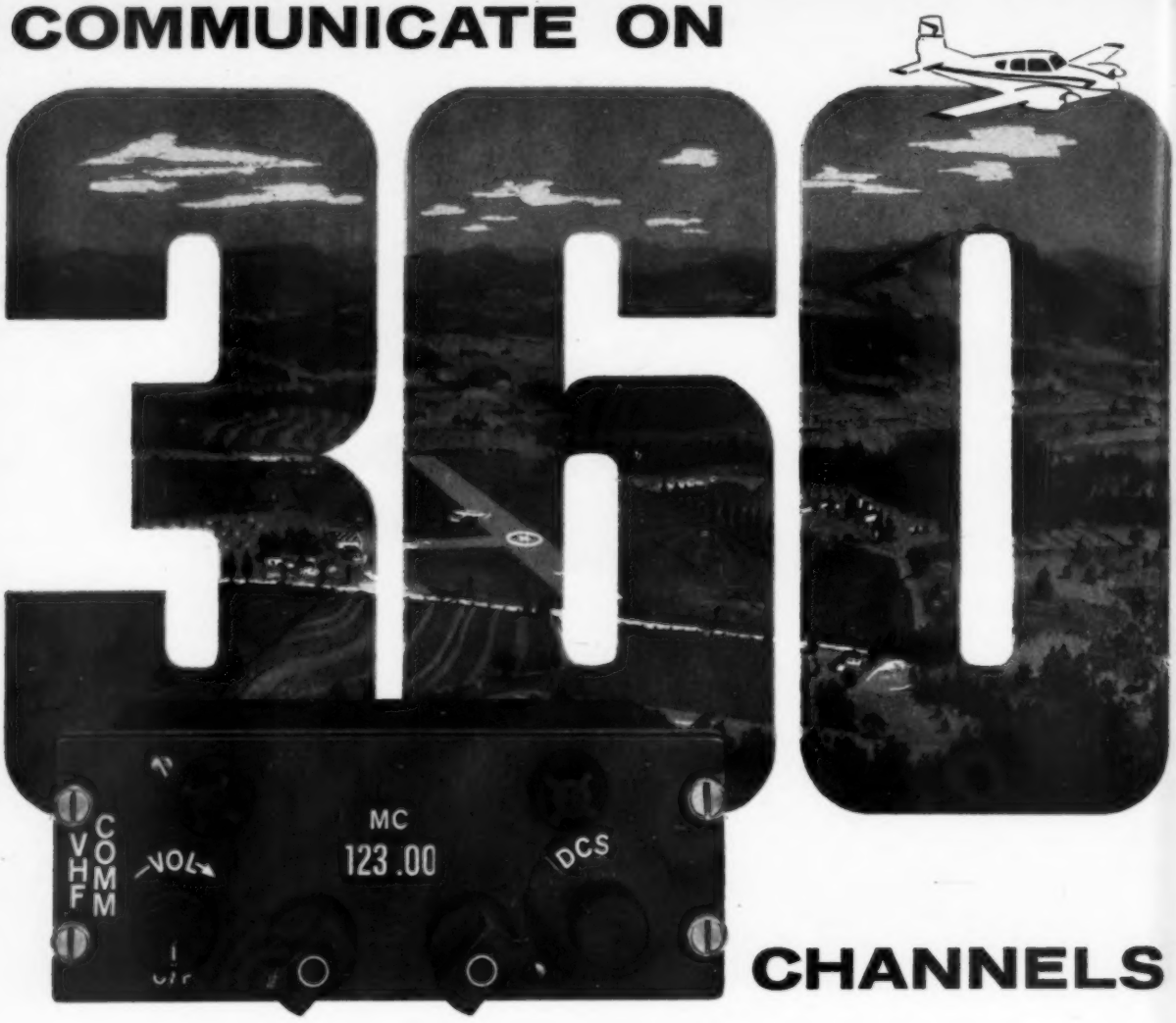
Short SB-5	UK

*Production versions of the Jetstar and Model 249 are being offered with Wright TJ 37 engines. The TJ 37 is a derivative of the Orpheus, jointly developed by Bristol and Curtiss-Wright.

Bristol Siddeley

ENGINES LIMITED

COMMUNICATE ON



CHANNELS

WITH ARC's TYPE 210 TRANSCEIVER

The rapidly increasing volume of air traffic and the need for more precise traffic control has necessitated a tremendous increase in the number of assigned radio frequencies to carry on the necessary air-ground communications.

Only a few years ago pilots could operate with 10 or 20 channels. Later frequencies were increased to 80 or 90. Plans now call for 360 frequencies—enough to meet the need for years to come. In view of this channel increase, ARC now offers an all-channel, flight proven transmitter-receiver (Type 210 Transceiver) covering all 360 channels. The powerful 15 watts guarantees optimum distance range and the knifelike selectivity assures freedom from adjacent channel interference. Provision has been made for the selective use of single or double channel simplex whereby transmissions are made on a frequency 6 megacycles higher than the receiver frequency. There is no wait between receiving and transmitting for re-channeling.

This is ARC's latest contribution to air safety. Ask your dealer for a quotation to include a single or dual installation, along with other units of ARC equipment listed below.

Dependable Airborne Electronic Equipment Since 1928

Aircraft Radio Corporation BOONTON, N. J.

OMNI/LOC RECEIVERS • MINIATURIZED AUTOMATIC DIRECTION FINDERS • COURSE DIRECTORS • LF RECEIVERS AND LOOP DIRECTION FINDERS
UHF AND VHF RECEIVERS AND TRANSMITTERS (8 TO 360 CHANNELS) • INTERPHONE AMPLIFIERS • HIGH POWERED CABIN AUDIO AMPLIFIERS
10-CHANNEL ISOLATION AMPLIFIERS • OMNIRANGE SIGNAL GENERATORS AND STANDARD COURSE CHECKERS • 900-2100 MC SIGNAL GENERATORS

30 YEARS OF ACHIEVEMENT 1928 ARC 1958 IN AIRBORNE ELECTRONICS

Jet Electronics . . . A New Challenge

For the U.S. scheduled airlines, the introduction of jets this year will involve a revolutionary step in air transport propulsion. In electronics, however, the change will be not nearly so radical. More likely it will be a mixture of "much more of the same," some new systems and antenna designs, and most important—a challenge to do as well or better in jet electronics as the carriers have fared in their piston-engine experience.

The task of meeting this challenge rests with what is unquestionably the least publicized but most influential body in commercial aviation electronics in the U.S.—Aeronautical Radio, Inc.'s Airlines Electronic Engineering Committee—better known as AEEC.

To this group jet thinking is not new. In fact it already has hurdled such problems for jets as developing an equipment characteristic for future Doppler navaids and flight recorders. Within 12 months of the first military declassification of Doppler information, it came up with airline industry agreement on what shape these systems should take. Flight recorders took even less time—only four months from when AEEC took on the project.

What is AEEC? In the more austere organizational language of Arinc it is a permanent committee of the Air Lines Communications Administrative Council (ALCAC) made up of airline superintendents and directors of communications. AEEC has 15 voting members plus non-voting membership from the Air Force, Air Transport Association, International Air Transport Association and ARINC.

In plainer language, however, AEEC is a committee that works—and gets things done. Its members act for the airline industry, not for the one carrier that signs their paychecks. Members from Frontier and Piedmont airlines speak for the U.S. local airlines. One from Sabena Belgian World Airlines coordinates AEEC activities with the major carriers in Europe. AEEC chairman William T. "Bill" Carnes, nine years removed from a post with Trans World Airlines, is a master in the art of coordination.

AEEC blends operations, maintenance and engineering know-how. Some members carry the load on equipment design, are adept at detecting basic fallacies in a system. Others can "smell" a deficiency in mechanical construction. Virtually every AEEC member can accurately predict the objections of the pilots of his airline to a particular piece of electronic gear; or can tell not only how much a new piece of equipment should cost but also how it will have to be priced if the manufacturer expects to sell it.

For committees in general and Washington-based committees in particular, AEEC has written an enviable record. Not once in its near-10-year existence have AEEC committee members been known to accept as an airline industry decision any measure, technical or otherwise, that was questionable. They have stubbornly held out for their freedom not to be regimented into anything which was not to their liking.

The best proof of their success and the support their decisions carry in airline electronics is borne out in one of the democratic procedural aspects of their committee operation. Once AEEC adopts a new electronic equipment characteristic, a 30-day "cooling off" period is granted all ARINC member airlines to raise any objection they may have to AEEC's decision.

Not once, in the history of AEEC, has there been such an objection that resulted in the disapproval of one of its characteristics, specifications or reports.

AMERICAN AVIATION'S special theme supplement on electronics and instruments tells the AEEC story, what it does, who does it and, even more important, what there is in AEEC activities to benefit electronic equipment manufacturers, the military services and aviation electronics throughout the world.

The Case of the Pencil-Sharpening Tower

(or How AEEC Functions by Bill Carnes)

One day, in the course of propagation studies, the National Bureau of Standards observes that signals at a certain ultra high frequency are reflected from television antenna towers and the reflecting characteristic depends on certain physical characteristics of the tower. Now this phenomenon —this bit of academic trivia—might have been recorded and all but forgotten, but for one man.

The man, an engineer in the aviation industry, reads a report of the NBS finding and recalls that the Civil Aeronautics Administration has built a large number of standardized rotating light beacon towers. And, although these often have been proposed for decommissioning, they are still in existence practically everywhere and their positions are accurately charted.

Preliminary testing discloses that very good reflection characteristics are obtained from these towers when a pulse signal is transmitted on a specific ultra-high frequency. By pure coincidence this frequency happens to be in a band of frequencies allocated to air navigation on a worldwide basis.

The question is: Just what earthly use would this technique have for an airline aircraft when the pilot is already provided with a great many navigation aids for giving azimuth and distance?

However, one airline technical man discusses the question with a set manufacturer and learns that the Tower Finder need be only a ½ ATR size, it would probably weigh 15 lbs. and could cost less than $500 because of its basic inherent simplicity.

Furthermore, a technique is possible which would permit the existing ADF Indicator on the aircraft to be employed with this Tower Finder to show bearing of the beacon tower as well as distance to the beacon tower displayed on the standard distance-measuring indicator in the aircraft. No frequency selector would be required since the equipment operates on a single frequency and almost any number of aircraft can share this one frequency.

About this time, one airline begins to show some interest but only to the extent of trying to determine what other airlines might also have interest. There are still many factors to be considered. For one thing, someone would have to study the CAA specification on towers and make sure they give the same reflectivity.

Other studies would have to be made to determine whether there might be other towers in the U.S. that would give similar reflecting characteristics and might be mistaken for CAA beacon towers. And, too, assurance would have to be received from CAA that the beacon towers are not going to be torn down or changed.

Further, it would be necessary for coordination to be effected on the established frequency for this Tower Finder to make certain that other navaids in this frequency band would not cause interference. And, most important, this new device must not interfere with other navigation aids which are already using that frequency.

So far, there is no universal agreement that a Tower Finder would have any really practical application. However, at this point the Airlines Electronic Engineering Committee may serve as a sounding board for the airlines, to discuss possible uses of a Tower Finder and determine whether practical equipment could be designed if these other basic questions could be satisfactorily resolved.

Next, the set manufacturers might agree to participate in any testing of the Tower Finder which might be required and, if the airline interest appears to justify the effort, the project would most likely be picked up by the Air Transport Association, which has basic responsibility for navaid systems and airline operational requirements for thorough review with the appropriate government agency.

If some degree of support is given to the Tower Finder project on the part of AMB, CAA, FCC, and perhaps the military, AEEC might then (simultaneously with the studies by ATA and the government agencies) proceed with hardware developments. AEEC would first establish a subcommittee with an airline chairman, probably the airline representative who originally developed the interest in the project.

Subcommittee meetings would be announced to airlines, manufacturers, government agencies and other interested observers and the first meeting would explore the background and develop enough of the requirements to permit the ARINC staff to draft a proposed equipment characteristic for the airborne hardware along with a very general statement of what the overall system specification might encompass.

Manufacturers who are new to the AEEC business will detect that the airline representatives seem to have great interest in the size of the box, the type of the connector on the back of the box and the number of wires running to the junction box and to other instrumentation and a very great enthusiasm for getting agreement on a standard airborne antenna physical configuration. No one from the airlines would appear to be the least bit interested in what goes inside the box! Manufacturers who have worked closely with AEEC in the past will, however, realize that this is just an airline man's way of emphasizing the importance of standardization to the set manufacturers and telling them not to finalize their form factor and mechanical designs until the industry has decided just what these should be.

Government and military representatives participate regularly in the AEEC Subcommittee meetings and provide the excellent informal coordination required to keep AEEC briefed on just what is likely to happen in the government agencies. Accordingly, it is usually possible for AEEC to go ahead with equipment development programs simultaneously with government policy considerations concerning the basic system.

In the case of the Tower Finder it might take many months or possibly years for the government to come out with a firm policy statement on whether the beacon towers could be employed for this application. However, AEEC meanwhile would be "read in" on all of the government discussions and the status of the studies.

Simultaneously, the AEEC subcommittee will be concerning itself with much more mundane matters. The discussions of form factor, antenna size and instrumentation have to result in a specific conclusion.

...wer Finder

There can be no half-way agreement on these physical characteristics if all sets are to be interchangeable. It is in the discussion of physical characteristics where the difference of opinion often develops among the airlines.

The first airline that showed interest in the Tower Finder may have been influenced in its planning by the fact that it had, in one fleet of aircraft, an empty ½ ATR space in the radio rack. Unfortunately, however, a pencil sharpener had been installed at this location in the cockpit. Accordingly, this airline will insist that the Tower Finder equipment have a self-contained pencil sharpener on the front panel because there is no other place to relocate it. From this airline's standpoint this is a real requirement.

Another airline has developed some interest in the Tower Finder, but in its Perambulator 361 Aircraft the radio rack faces rearward. This airline agrees the pencil sharpener attachment is a very useful feature but that it should be on the back of the equipment.

At this point the matter of cost enters into the picture. In this case, manufacturers may conclude that the addition of the pencil sharpener (a very special, miniaturized, highly reliable, electrically driven, transistor-stabilized pencil sharpener) as a standard item would add 20% on to the price of the equipment if all customers bought the standard unit, but if it were left off as the standard, it would cost 50% additional for each of the airlines that wished the special sharpener arrangement on his systems.

Without any unified interest in the pencil sharpener, the additional cost probably would be unacceptable to the majority of the industry, and the airlines that insisted on the special pencil sharpener installation would be only too happy to back down in their demands.

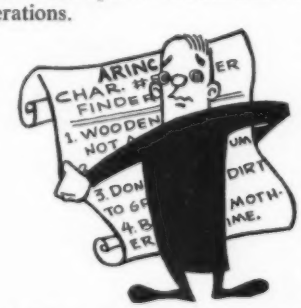
But if the additional cost had been 5% instead of 20% the whole industry might have agreed to accept the unnecessary pencil sharpener just to get industry agreement and help out the airlines that really needed them. (An actual example of this industry cooperation and recognition of a special requirement of one of two airlines, is the indicator on the Weather Radar for recording the operating time of the magnetron. Initially, this was considered in exactly the same vein as the pencil sharpener, with almost negligible airline interest except for one or two airlines, yet it has since become the standard and has been widely used by all airlines.)

After the pencil sharpener question is resolved, the remaining problem may be to choose the particular form factor of antennas and equipment. In most cases, the AEEC will take the advice of the manufacturer they believe has gone the furthest in the development of the equipment. But, usually, they will encourage a slightly smaller case size than the manufacturer would normally prefer.

A second problem which will face the committee in establishing the physical characteristics will be the instrumentation and its circuitry. Each manufacturer that is new to AEEC activities will always propose an overall system concept that takes a lot of the electronic equipment out of the radio rack unit and moves it to a very large indicator, which is also very special, to be mounted on the pilot's instrument panel.

The airlines cannot accept this concept because instrument panel space is at such a premium it is better to accept more volume, weight and some increased cost in order to get the bulk of the electronic gear into the radio rack, leaving an absolute minimum at the indicator.

This "system thinking" seems to be very difficult to get across to set manufacturers who are used to working with the military and where the equipment and system is usually the full responsibility of the set manufacturer rather than the customer. In dealing with the airline industry a set manufacturer must come to realize that airline people are rugged individualists. They have had many years of experience in operating commercial aircraft and they know the pitfalls of incorrect system concepts in commercial airline operations.

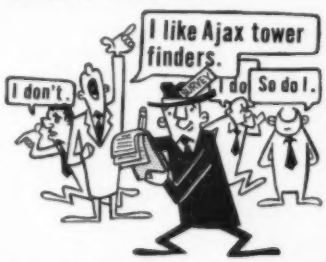


In the case of the Tower Finder, therefore, although numerous discussions have taken place on the basic system design, the indicator concept and the internal circuitry of the electronic gear, it is unlikely that there will be very much in the ARINC characteristic that tells the set manufacturer specifically how to design the internal circuitry of his equipment.

As soon as a reasonably final draft of the ARINC characteristic for the Tower Finder is ready, it is submitted to the full AEEC membership at one of the regular general sessions of the committee, which are also open to manufacturers and others. And, except for relatively minor changes, it is reasonably certain that the final draft characteristic will be endorsed.

However, approving this final draft serves an important function in the total process. If this characteristic were simply "rubber-stamped" by the industry without digging into the background and details, these many questions would be raised later on by the individual airlines not represented in the subcommittee meetings.

After an AEEC meeting has approved an ARINC characteristic, the set manufacturers make their final market survey to determine whether the airline industry really will purchase equipment to the ARINC characteristic. If their market survey confirms, as it usually does, the correctness of the ARINC characteristic, they will plan production on the basis of their market survey and not on the basis of the ARINC characteristic.



Now that the ARINC equipment characteristic for the Tower Finder is completed and approved by AEEC, publicized through extensive and detailed discussions in an AEEC general session and subsequent mail circulation, the next step is up to the airlines. Usually one or more airlines are just making commitments for a group of new airplanes and they may use these aircraft as guinea pigs.

Accordingly, the airframe manufacturers will be receiving requests from airlines to make a standard installation in accordance with the ARINC characteristic for the Tower Finder. The airframe manufacturers have been brought in on all of the development work of AEEC, and their engineers already have been making production and income if he has to preliminary plans for installations as they know they will get requests as soon as the ARINC characteristic gets close to being final.

ARINC 565 Tower Finder Built by Ajax Radio Co. (Standard ARINC Form Factor used)

Tower Fi... Built by D... Elect. Co. (St... ard ARINC F... Factor not us...

Several set manufacturers may have been working on development programs *(turn page)*

while the characteristic was being hammered out, but actual hardware may not exist for some months or even years. Here is where the standardization finally pays off for the airlines.

He can specify a standard set of interwiring, standard mountings and standard antenna cut-outs and be reasonably certain that at least several manufacturers will, within the next six months to a year, come up with equipment designs which will fit those standard installations.

It might appear that the only advantage of this standardization is in the eyes of the user. This is not true. Taking the Tower Finder characteristic, one manufacturer usually will be somewhat ahead in development. This manufacturer can show a prototype set first and if this Tower Finder is of sufficient importance to a particular airline it may place orders with this first manufacturer simply because the competition has nothing to offer at the time it must make the decision.

The problem that faces the next manufacturer is whether he should drop his project, or should continue the development and shoot for other airline orders and possibly some orders from the first airline on the "second time around." If systems are interchangeable, he can expect a reasonable chance of selling the airline on the second time around.

For the Tower Finder, the industry may on occasion choose to take a calculated risk in going ahead with the issuance of an ARINC characteristic even though not all the answers may be forthcoming from the appropriate government agencies. If the chances look good for the eventual endorsement of the system by the government, the industry may choose to proceed with the issuance of an ARINC equipment characteristic.

It should be pointed out however, that unless there had been some indication that similar towers were available or could be implemented in other parts of the world, it is very unlikely that the Tower Finder project could ever get off the ground in this country. The airline industry today has too many problems of non-standardization between countries.

But if these towers were available, AEEC's coordination, world-wide, would be effected through the many airlines and organizations which follow the work of AEEC. In this case, IATA (The International Air Transport Association), ICAO (The International Civil Aviation Organization of the United Nations) and the other groups throughout the world would be contacted informally.

The IATA Technical Conferences, held yearly, provide an excellent meeting ground whereby the operational requirements can be discussed among airlines, and with manufacturers, on an international level.

Furthermore, the European Airlines Electronics Committee (which is represented on AEEC by its chairman) can do much to coordinate the equipment problems peculiar to the European Airlines on any proposed system or equipment. Other organizations, such as Amalgamated Wireless in Australia, and International Aeradio Ltd. (IAL) in England, can provide similar functions and liaison in their respective parts of the world.

The results of AEEC initial deliberations on such matters are often not established as official policy by governments for many years later. However, there have been several cases in the record where frequencies, system standards, and minimum requirements for equipment have been adopted as a part of international treaties or international agreements based on developments and conclusions initiated by AEEC many years before.

This article is based on a fictitious example. There is not, never has been and probably never will be a tower finder—with or without pencil sharpener. But if there ever is, this could be the way that the AEEC would expedite its development.

AEEC: 350 Years of Electronics Know-How

William T. Carnes

Carnes has been chairman of AEEC since 1951. Also manager of electrical engineering at ARINC, which he joined in 1949, he has been active in several committees of Radio Technical Commission for Aeronautics and has served as an adviser to U.S. delegation to several ICAO communications division meetings. Joined TWA in 1937. Named acting superintendent of communications 1944, superintendent of radio engineering 1945. Author of ARINC Synchro System Manual (1950).

Frank C. White

A staff engineer for the Air Transport Association since 1949, White is chairman of an ATA/AEEC subcommittee, dealing with proximity warning indicators. After a stint in the Signal Corps Radar School, Hobe Sound, Fla., he served in the Navy's office of the director of aeronautical communications, 1943-46. After the war, he spent three years with American Airlines, as superintendent of electronics engineering, flight engineering division.

William S. Smoot, III

Secretary of AEEC and the Airlines Electronic Maintenance Meeting since November, 1957, Smoot is a technical staff assistant at ARINC. His work is principally in the field of frequency engineering. Starting as a radio inspector with The Glenn L. Martin Co., he has been with Fairchild Airplane and Engine Corp. as electrical inspection engineer, with Capital Airlines as project engineer and Collins Radio Co. as aviation sales engineer.

F. J. Todd

Superintendent of aircraft radio for United Air Lines for the past 16 years, Todd has been a member of AREC and AEEC for 17 years. He's also chairman of the AEEC subcommittee on visual communication systems. Attended RCA Institute, where he studied communications engineering, and Boeing Aeronautical Institute. Holds a Presidential citation for his aid to the National Security Resources Board when the Civil Reserve Air Fleet program was launched.

Ben F. McLeod

Systems communications engineer for Pan American World Airways, McLeod has been a radio amateur since he was 13. Graduated from Clemson College, Clemson, S.C., in 1939 and joined PAA in Miami same year as junior radio engineer. Promoted to present post in 1947. Since 1946 he has worked with various committees of ICAO, IATA, ATA, RTCA and ARINC. McLeod is chairman of three subcommittees of AEEC, those dealing with aircraft installation, single sideband and Doppler radar.

Walter D. Rollick

Assistant superintendent of communications, Piedmont Airlines, Rollick began his career 20 years ago as a radio officer in the Merchant Marine. Formerly a communications chief for Eastern Air Lines in Birmingham, Ala., he joined Piedmont in 1947. A member of AEEC since 1951, he has served as chairman of its maintenance sessions, 1952-57.

R. C. Dombaugh

Supervisor of radio engineering for National Airlines, Dombaugh has been with the company for 20 years. After taking extension courses at the University of Cincinnati, he joined the U.S. Coast Guard in 1926, serving at New London, Conn. and Boston. Spent nine years in the automobile garage business before joining National in 1938. Started in the airline's communications department and has moved steadily up the ladder to his present responsible post.

Richard White

Manager of electronics engineering for Trans World airlines, White has been a member of AEEC since 1949. A graduate of the University of Kansas, he was superintendent of radio, electrical and instrument engineering at the TWA overhaul base at Fairfax Airport, Kansas City, Kan. before being promoted to his present post with the airline. He is a former chairman of the Radio Aids Group of the International Air Transport Association.

Siegbert B. Poritzky

Poritzky is a staff engineer for the Air Transport Association, in its air navigation and traffic control division. He graduated from Iowa State College in 1946 and studied at Washington University, St. Louis, and Georgetown University, Washington, D.C. Formerly with TWA as a ground station radio engineer and with McDonnell Aircraft Corp. as senior research engineer. Joined ARINC in 1953 as electronics engineer and secretary of AEEC. Left ARINC to join ATA.

Maurice Nerincx

Chairman of the European Airlines Electronic Committee, Nerincx heads the engineering department of Sabena Belgian World Airlines. Graduated from the University of Brussels in 1946 and joined Sabena that year. For several years he was in charge of the overhaul shop for radio, instruments and electricity. Later he was transferred to the engineering department, with responsibility for electronic installation projects.

H. W. Mehrling

Chief, electronics engineering for Eastern Air Lines, Mehrling graduated from Ohio State University in 1935, joined TWA same year. In 1937 he moved over to Eastern and has been with company ever since. Chairman of AEEC's Instrumentation Subcommittee, which is studying instrumentation interrelationships in electronics navigation systems.

Harold A. Ferris

Technical assistant to the director of telecommunications, Trans-Canada Air Lines, Ferris served during World War II as chief engineer of the Royal Canadian Air Force Section of the National Research Council in Ottawa. In 1946 he joined TCA in the position which he still holds. Ferris has been active in the Radio Aids Group of the International Air Transport Association and various other committees. He has been a member of AEEC for 12 years.

Ralph O. Smith

Staff advisor of the Directorate of Communications-Electronics, Headquarters, USAF, Smith is a former director, treasurer, vice president and president of ARINC. Formerly superintendent of communications and superintendent of maintenance for Capital Airlines, he has served as senior staff member of the President's Communications Policy Board. Born in Berea, Ohio, he attended Baldwin Wallace College, in his home town.

George W. Anderson

Project engineer for Capital Airlines, Anderson started with company 20 years ago as an apprentice mechanic. Promoted to supervisor of ground communications in 1948 and project engineer in 1955. Has been member of AEEC for the past two years and has served with other ARINC committees. He attended Carnegie Institute of Technology for four years, studying nights while working days. First job was with Research Laboratories of Gulf Oil Co., where he spent three years.

E. H. Brown

Superintendent of aircraft radio equipment for American Airlines, Brown is celebrating his 25th anniversary with the airline this year. He joined American in 1933 as a radio technician in the company's overhaul base in Pontiac, Mich. In 1939 he was promoted to foreman of radio fine maintenance at LaGuardia Field, New York. Born in Scottsville, N.Y., he was educated in Rochester.

Ludlow B. Hallman, Jr.

Technical director of the Communication and Navigation Laboratory, Wright Air Development Center, Dayton, Ohio, Hallman has published 16 papers covering various phases of radio and electronic engineering. He received his electrical engineering degree from Alabama Polytechnic Institute in 1934. During the war years, 1942-46, he did pioneering work in electronic beaconry for which he received the War Department commendation for meritorious civilian service.

M. E. Knox

Supervisor of aircraft radio engineering at Northwest Airlines, Knox has been identified with ARINC since 1943. He joined its Aircraft Radio Equipment Committee when it was organized in 1945. Since 1951, he has been Northwest's representative in ARINC and also has served continuously as a member of AEEC. Knox joined NWA in June, 1936 and has been with that company ever since.

H. O. Harrison

Assistant director of communications, Braniff Airways, Harrison has been a licensed amateur since 1932. He joined the Navy in 1935 as a radio operator and technician. While in the Navy he studied radio engineering at Capitol Radio Engineering Institute, Washington, D.C. Harrison joined Braniff in March, 1940 as a radio operator, soon transferred to maintenance and has moved up steadily. He has been a member of AEEC since 1949.

Stanley Krejcik

Krejcik is assistant to the technical director of the International Air Transport Association. Born in Czechoslovakia, he graduated from Prague Technical University and served with the Czechoslovak Air Force, in which he studied aeronautical engineering. Employed by Electro-Praga Ltd. as a design engineer of electro-thermal apparatus and appliances. Served with the French and British air forces, becoming a squadron leader. A member of IATA's staff since 1946.

E. G. Jones

Assistant superintendent of communications, Delta Air Lines, Jones joined Delta in 1937 as a radio electrical technician. Has held present position since 1946. Responsibilities involve ground radio, aircraft radio, radar, teletype and telephones. Jones' 21 years of experience in aviation includes service, installation and layout of radio systems for all types of planes from the Stinson A Trimotor to the DC-8 and the Convair 880.

Clyde C. Longhart

Superintendent of communications for Frontier Airlines, Longhart began his career in aviation communications during World War II as a civilian employe of the Army Signal Corps. He joined Frontier in August, 1946 and has been in charge of the radio department ever since. Born in Kansas City, Mo., but has lived in or near Denver most of his life. A member of the Institute of Radio Engineers.

Peter Wolf

Director of communications for Western Airlines, Wolf graduated from the Radio Corp. of America Institute for Advanced Radio. His first position in the field was as superintendent of communication for Grand Canyon Airlines. In 1937, he joined Western as a communication operator, technician and radio shop foreman. Since 1941 he has been the airline's director of communications.

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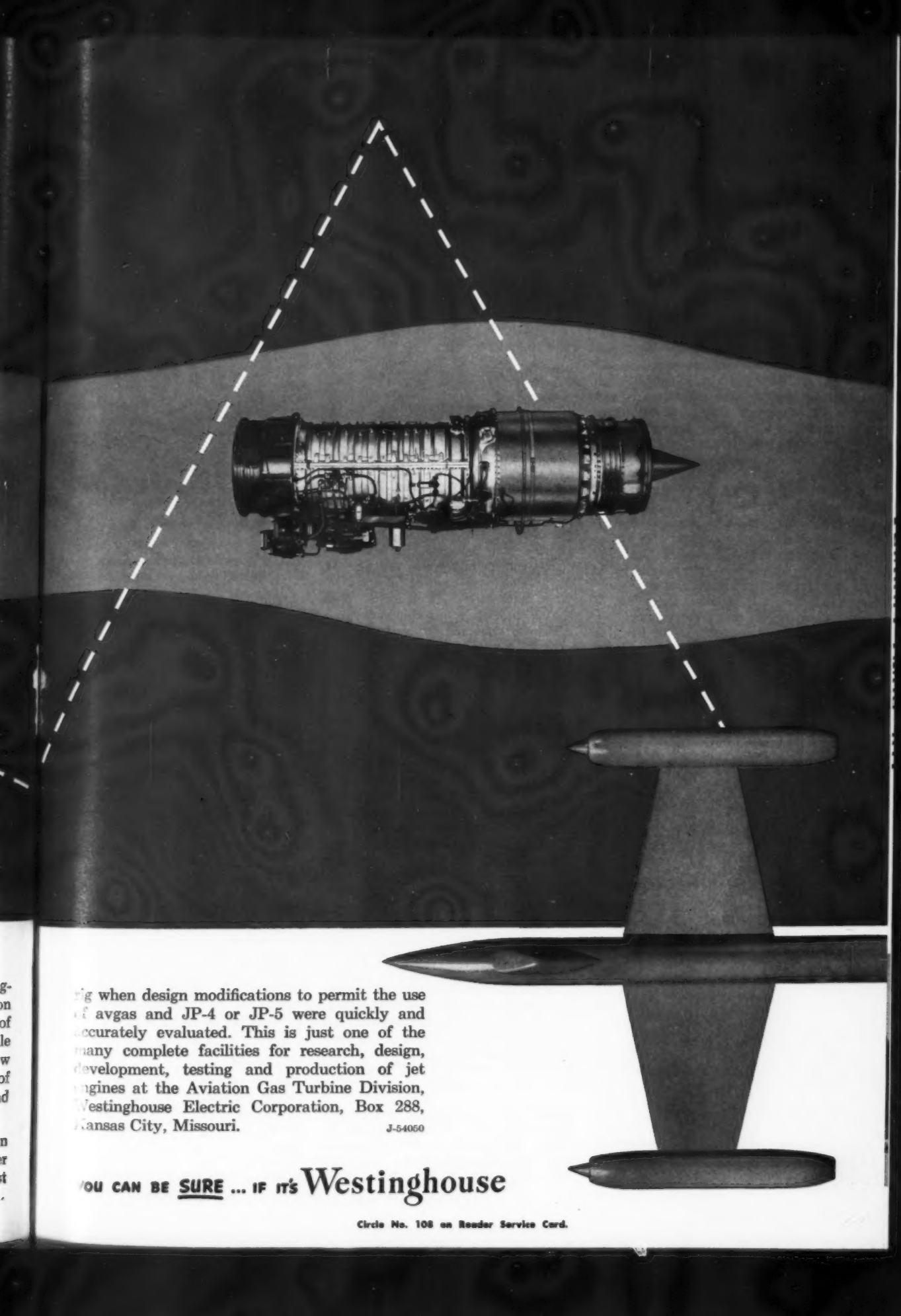
Development of the latest J34 configuration for use in North American Aviation's T2J trainer proved the value of this water flow analogy test



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Designing Better Electronic Gear

AEEC clarifies airline needs for manufacturers, but swiftly changing factors make it risky business—Doppler development costs are astronomical

By E. C. Whitaker
Aviation Sales Manager,
Collins Radio Co.

The greatest benefit derived by a manufacturer as a result of participating in activities of the Airlines Electronic Engineering Committee is that of a better understanding of the "operational requirements" of the airlines.

In airline electronic equipment such an operational requirement means any device that will enable the airline to operate the aircraft farther, faster, more economically, at greater passenger comfort or convenience, or more safely.

With the exception of the safety needs, any of the remaining operational requirements must be assessed by each airline in economic terms as to its value to that individual airline. The airlines consistently have demonstrated a willingness to buy and use any equipment that will promote the safety of the passengers and crew members, or that will promote the safety of other persons to whom the aircraft is a potential hazard.

This has not always been the case with all electronic gear, hence knowledge of the airline operational requirements proves invaluable to the electronics manufacturer.

The history of civil aviation is littered with cases in which electronic equipment designed and built at great expense to a manufacturer was not bought by the airlines. In many of these cases the device was a well-designed, reliable piece of equipment, but did not sell for the simple reason that an operational requirement did not exist.

This type of situation implies a basic lack of knowledge on the part of the manufacturer as to how the airlines operate their aircraft. Or alternatively, the electronic manufacturer may have supposed that an operational requirement would arise but it never materialized.

Such a situation may arise rather easily since the electronics manufacturer, in most cases, must begin development of equipment two to five years prior to an estimated date the airlines will actually be using the equipment.

• **Can't anticipate everything**—For the most part AEEC attempts to anticipate operational requirements sufficiently far in advance of equipment development to permit preparation of an ARINC characteristic. However, because operational requirements arise in what sometimes seems overnight, this does not always occur. Often logical and valid reasons exist as to why equipment characteristics are not always available. However, a manufacturer may foresee a potential need among the airlines for equipment of a particular type and proceed with development without the benefit of an equipment characteristic.

Only with a complete and thorough understanding of the individual airline's requirements and operational needs can the manufacturer begin development of airline-type equipment with any reasonable assurance that his product eventually will be purchased by the airlines. For the convenience of the manufacturers and the airlines, many parameters of electronic systems and electronic equipment, which are unnamed and yet to be devised, are available as a result of cooperative efforts between the airlines, airframe manufacturers and electronics manufacturers. Some of these parameters include standardized form factors, preferred construction technique, and preferred components.

Although development of an equipment characteristic by AEEC certainly denotes firm interest among the airlines in such equipment, it does not follow that all airlines in the world or all airlines in the United States have need for such equipment.

LEAD-TIME of three-five years faces electronics manufacturers competing for airline business, as exemplified by Collins 17L-7 VHF transmitter.

Naturally the individual airline's interest in such equipment is determined by its route structure, type of aircraft being operated and other factors. The electronics manufacturer must make his own determination of the market conditions as well as an evaluation of competitors' status.

Occasionally a manufacturer may decide to deviate from an ARINC characteristic when designing equipment. This action can be taken without great risk on the part of the manufacturer only after a thorough study of the operational requirements of the interested airlines, and proper coordination with the airframe manufacturers from whom the airline is purchasing aircraft.

And occasionally an electronics manufacturer offers a new equipment to the airlines industry but is unable to sell

'Unforgivin

By Clarence I. Rice
Product Manager
Bendix Radio Division
Bendix Aviation Corporation

"The air—to an even greater extent than the sea—is terribly unforgiving of any carelessness, incapacity, or neglect." This quotation could very well be a part of the underlying philosophy of the Airlines Electronic Engineering Committee (AEEC) of Aeronautical Radio, Inc. (ARINC).

The characteristics (or specifications) which are prepared by the committee are the result of careful though: on the part of the committee members, as well as the equipment and airframe manufacturers who participate on an advisory basis. The responsibility for providing the best equipment for safe air transport operations under all weather conditions is keenly felt by all participating groups, and the characteristics reflect this conscientious preparation.

This is one of the reasons for the excellent record of aviation electronic equipment in performing many basic navigation and communications functions in all types of weather for many years.

An ARINC characteristic is not used as a specification for a design contract with an equipment manufacturer, and cannot even be taken as a commitment to purchase such equipment after it is designed: In view of this, an electronic equipment manufacturer must decide if company objectives will permit successful competition in the market, and

it to the airlines even though an apparent operational need exists. Quite often this situation is due to the fact that the equipment is actually available prematurely from the standpoint of operational need, or is so late that it must be considered only on a retrofit basis by the airline.

In the latter case, strong economic justification must exist if the airline can be expected to purchase and install the equipment. This is true whether the equipment is expected to replace existing units with a newer and more modern version, or whether it is expected to perform a new service.

• **Spares requirements complicate matters**—phasing of newer and more modern equipment into an existing airline fleet presents a special problem to most airlines due to spares requirements. As an illustration, a typical airline might require 25 pieces of equipment in the spares group to adequately support 100 aircraft.

If 10 aircraft were added to this fleet and these 10 additional aircraft utilized a different type of non-interchangeable model of electronic equipment, the spares group would continue to require 25 units of the older type or model and, in addition, would require 25 units of the newer type or model.

If, on the other hand, the 10 new aircraft added to the fleet utilized equipment the same as or interchangeable with the original 100 aircraft, the total spares group might increase only to 27 units.

The willingness of the electronics manufacturer to design and manufacture equipment to meet airline needs is demonstrated by the fact that no less than six manufacturers are currently developing equipment for the airline Doppler navaid program. It is conservatively estimated that the aggregate development cost to these manufacturers will be about 40 to 50% of the total market potential for the next 10-year period. Present indications are that not all of these manufacturers will share in the airline business. The manufacturers who do not have airline acceptance of their equipment will have plunged a lot of capital into a development program which has netted nothing. This will be due primarily to a lack of knowledge of airline requirements or an unwillingness on the part of the manufacturer to accept *all* of the necessary responsibilities incidental to sale of equipment to airlines.

The field of electronics occasionally has been represented to be a panacea for airline needs, but the panacea can be approached only when the electronics manufacturer understands airline needs. Much of this understanding is derived by the manufacturers through participation in AEEC.

...ir Makes Things Tough for Planners

gamble on various product developments on the basis of their expected contribution to the safety and reliability of air travel.

The business and private aviation industry is also an important segment of the potential market, because the requirement of those groups for equipment meeting the highest standards is constantly increasing as a result of all-weather operations between all types of airports.

In designing aviation electronic equipment many factors have to be evaluated in order to achieve the equipment having the best balance of desired characteristics, with many desirable characteristics being in direct conflict with each other. This balancing is an important part of the ARINC committee activity, and is continued by the manufacturers during the actual design of the equipment. A manufacturer's competitive success depends upon a thorough knowledge of the desired characteristics, their relative importance, and his ability to convert this knowledge into practical hardware.

• **Three main design factors**—The design factors can be divided into three broad groups: namely, operational, installation, and maintenance factors. In all three groups safety considerations are of paramount importance.

The most important operational factors to be considered in a design are reliability, technical performance, simplicity of operation and/or indication, and fail-safe operation. Reliability is one of the key design requirements for safety and economic reasons. Specifications which will improve reliability are included in the characteristics when they can be anticipated. Others are often included during the design.

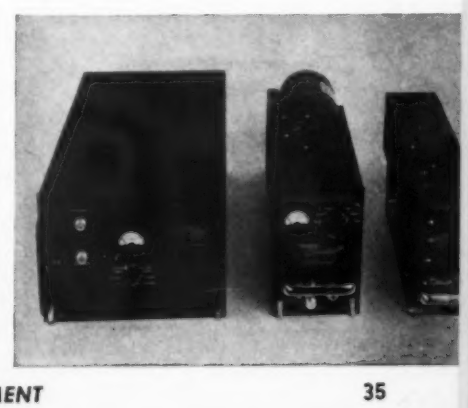
The technical performance expected of the equipment is also specified in the characteristics for the guidance of the manufacturers. In order to provide an extra margin of safety the performance requirements are more stringent in most cases than the minimum legal standards required for safe aircraft operation under CAA Instrument Flight Rule (IFR) conditions. The requirements of the operational controls and/or indicators are also resolved during the committee deliberations, with the assistance of operational experts, for implementation by the manufacturers.

The installation factors are a very important part of AEEC characteristics because of the airlines' desire for systems interchangeability in the aircraft between equipment designed by various manufacturers. The coordination of requirements, such as space, primary power, interconnecting wiring, cooling air and equipment mounting can best be resolved during the preparation of the AEEC characteristic, and this information is of substantial value to manufacturers during the design work.

• **Maintenance characteristics difficult**—Maintenance factors, such as unscheduled removal rates, total equipment life, accessibility of components for replacement, interchangeability of units and parts without special selection, and overall maintenance cost, are very important in designing equipment, but are difficult in most cases to specify in the AEEC characteristics, or measure accurately.

At the present time it is desirable that the electronic equipment operate for at least an engine change cycle, which is over 1,500 flight hours in many cases, before failure or removal for routine maintenance. The operating-life objective for this class of equipment is over 50,000 hours.

Some of our equipment which was manufactured 20 years ago is still in service. During the life of an equipment, it has been estimated the normal maintenance cost exceeds the original purchase price by a ratio of ten to



RESULT OF REFINEMENT is demonstrated by unit at extreme right, which has twice as many channels, same power output but is only one third original size.

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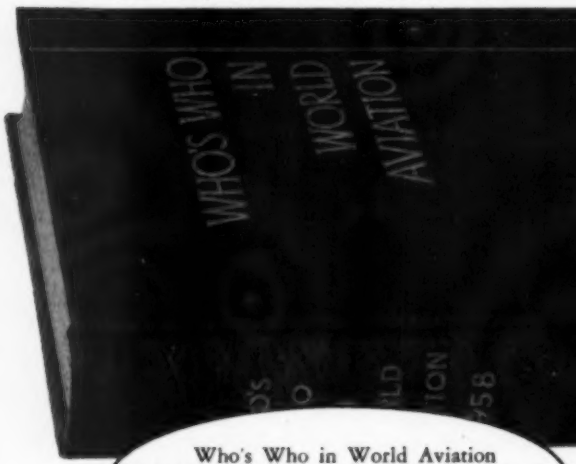

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DOOLITTLE, James Harold, v. p. and dir., Shell Oil Co. *Office:* 100 Bush St., San Francisco, Calif. *Home:* 1100 Sacramento St., San Francisco, Calif.

b. Alameda, Calif., Dec. 14, 1896; m. Josephine E. Daniels; children, James Harold, Jr., John Prescott. *Educ.:* U. of California (1916-17), A.B. (1922); Massachusetts Inst. of Tech., M.S. (1924), Sc.D., fellow in Ae.E. (1925). *Business record:* mgr., aviation dept., Shell Petroleum Corp., 1930-40; present position since 1946; first to fly across U.S. in less than 24 hrs., 1922; first to fly outside loop; win- Trophy Race, 1925; award- phy, 1926; Harmon Trophy. ndix Race, 1931; trans- 1931; winner Thomp- 1932; advisor Congres- icy Bd., 1948; chrm. mm., 1952. *Military* ir Corps, 1917-30; estigation Comm. duty as maj., n., 1942; maj. dr. 12th A.F., Air Forces: m. Sec. of relation- Security essional leaf oak leaf Natl. Off.) n Le- oix de with Palm (French); Grand Off. of the Order of the Crown with Palm

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. . . Evolution of a unit

one. This emphasizes the importance of giving maintenance factors high priority during design, and also points out the false economy of procurement on the basis of original price rather than ultimate total cost.

• **Evolution of a typical unit**—The evolution of a typical aviation electronic unit today reveals an interesting picture. The Bendix TA-18 VHF Transmitter was designed in accordance with the AEEC characteristic for such a unit almost ten years ago. It is a full-length 1-ATR unit weighing approximately 43 lbs. It was superseded by the Bendix TA-20 VHF transmitter of exactly one-half the original size three or four years ago.

This second unit is presently being superseded by a Bendix TA-21 transmitter which is packaged in a short, 3/8-ATR form factor, and weighs about 14 lbs. The latest unit provides twice as many channels as the original transmitter, has a comparable power output, and represents a weight reduction of 67%, and a volume reduction of over 70%.

A typical airline complement of our aviation electronic equipment of three years ago has been reduced from 460 lbs. to 206 lbs. with a volume reduction of 60%, and a corresponding reduction in power consumption. In addition, the performance of many of the units has been significantly improved.

Knowing from experience that new designs will have some faults in spite of all the thought behind AEEC characteristics and manufacturers design work, those concerned with product improvement and service programs are very much aware of their importance.

Usually, the manufacturer who has demonstrated that his organization will back up the equipment with good field service is in a favored position when new business develops.

We have a quality report card system for insuring that our equipment is in good condition when initially received by our customers. A reliability report card for routine reporting on shop maintenance work is extremely valuable in our product improvement program.

A thoroughly prepared AEEC characteristic, coupled with competent design and skillful manufacturing, and feedback of factual field service information, will result in aviation electronic equipment of the highest quality and reliability.

Members of AEEC are convinced that this kind of cooperation will insure continued progress toward the industry goal of safe, reliable all-weather operations.

Electronic Reliability . . .

The Military Specifies It, Airlines Get

The basic approach of the U.S. military services and that of commercial airlines to electronic reliability is as different as night from day. And the results often prove just as contrasting.

Why? Bigness is one answer. Because of the size of the government's operation and the stringent procurement laws under which it operates, the military must follow an entirely different approach from that pursued by the airlines. The military must look on reliability as a contractual matter, whereas the airlines can get it as a moral responsibility from any reputable manufacturer.

Not that the military hasn't emphasized reliability. To the contrary, the military goes to great lengths to spell it out as a contractual requirement in the so-called "quality assurance" provisions in its specifications.

But there are other handicaps. The military purchasing official is under pressure to award contracts on the basis of competitive price bids even though he may know that one manufacturer will do a far better job than another. And in many cases the man making the contract award has no knowledge of the past performance of the bidders, or if he does, it may be confined to the ability to meet delivery schedules.

More than likely he has no responsibility for operational reliability of the product purchased and may never learn whether or not a piece of electronic gear proved satisfactory in service. He can merely tell his superior that two or more producers will contract to meet a given MIL specification. The result: a manufacturer has no choice but to cut his costs to the absolute minimum necessary to comply with the exact terms of the quality assurance provisions in a specification.

This is a simple fact of life and one not easily solved. However, military reliability experts today recognize this handicap and are exerting every effort to come up with more realistic and meaningful quality assurance specifications.

• Commercial picture different—In commercial business it's an altogether different picture. The manufacturer is not saddled with a binding specification by his prospective customer. This loses its importance because of a continuing close relationship between the specialist who buys electronic gear, the engineer who selects it, the pilots who use it and the mechanics who maintain it.

An airline today may place an order with Doaks Manufacturing Co. for a model XY-47 radio with nothing other than the model number specified.

There is no need to specify anything about reliability. The airline knows it is dealing with a reputable and experienced manufacturer and that it can expect action if the equipment doesn't perform. Any manufacturer intending to remain in commercial business couldn't expect to survive for long, if he could not back up his statements to an airline customer.

If he meets a specification but the equipment still is not satisfactory to the customer, it is not enough for him to tell the customer "it meets the spec and the spec was written wrong!" He must recognize that he is dependent on that customer and the airline industry for his future business.

When military equipment is purchased to a specification and accepted by an inspector, the electronics manufacturer no longer really has a basic responsibility for the equipment. Often a set manufacturer would gladly accept some further responsibility, but is rarely called upon unless additional production runs are ordered. And this may never happen as a different manufacturer may get the business next time.

But in every instance in the military, corrections of equipment are made on the basis of spec changes rather than dependence on the manufacturer-to-customer-to-manufacturer feedback of service information that prevails on the commercial electronics scene.

There are instances in the military where new equipment goes to warehouses rather than into aircraft and some time elapses before it gets any service. If trouble develops, it is most unlikely the set manufacturer will be told about it. An airline aircraft can accumulate up to 3,000 hours flying a year, whereas for the military, 300 hours would be quite a lot.

Although the military may order 1,000 items and install them immediately, an airline could order one-tenth that number and accumulate 10 times as much operational service experience during a particular period. The airlines may take only three months to learn what happens to equipment after 1,000 hours of service life while the military would require three years to learn the same results.

• Military uses ARINC research—Military recognition of this fact was borne out in its contracts with ARINC over the past several years involving reliability studies on electronic tubes and entire systems. This activity also led to the recent formation of a subsidiary, ARINC Research Corp., to provide reliability service for commercial and government customers.

One of the better examples of what the airlines have accomplished in the way of reliability is typified by the airborne radar program. The military at the time had experienced serious difficulties with all magnetrons used in radars.

The airlines approached the manufacturers and made it clear they would not accept magnetrons with reliability demonstrated in military use. The manufacturers took the challenge seriously and not only agreed to design a new magnetron for airline use but encouraged radar manufacturers to be more conservative in their use of the tube.

As a result, the first airline experiences with weather radar disclosed a mean life of magnetrons about 20 times better than the best previously realized by the military.

The airlines did not write a specification for the magnetron. But at least one commercial manufacturer felt so sure of his ground that he was willing to guarantee a minimum life on every tube delivered to the airlines.

If one were to compare an ARINC equipment characteristic with a military specification for the same equipment today, he might come away with the impression that the military is far more conscious of reliability. In words, that is the case. In results, obviously it isn't. Probably the best example of how ARINC gets the point across for the commercial airlines is a recent ARINC characteristic which was based on a new piece of equipment intended to be compatible with an Air Force specification.

In that portion of the ARINC document dealing with the so-called quality assurance provisions, this is the approach:

"The commercial user generally endorses the provisions in the MIL spec for assuring proper design and reliability of such equipment. However, because of the difference in procurement practices of the civil and military customer, there is no requirement in this ARINC characteristic for specific

Here's Why

design tests, specific testing schedules or specific acceptance tests.

"The nature of the continuing business and technical relationship between the commercial customer and equipment supplier is such that quality can best be assured by taking advantage of the competitive nature of the commercial electronic business. The commercial user does, however, strongly encourage the set manufacturer to conduct tests, such as are suggested in the MIL specifications, for his own use in ascertaining circuit design faults, production problems or possibly rating limitations.

"Set manufacturers should note the information in ARINC reports 402A and 403 regarding the rating of tubes and tube environment as well as the many status reports on the ARINC surveillance tests of special quality tubes which have disclosed many common faults of equipment design relating to electron tube applications.

"A full and detailed compliance with the Quality Assurance Provisions of the MIL specifications does not provide assurance against design faults and is not an excuse for failure to recognize common design faults pinpointed in such reports."

Business Flying Boosts Electronics

An ever-narrowing gap between the wants and needs of airlines and those of the larger business transport operators is merging the electronic equipment market of the two into a business of big proportions.

In AEEC's prime mission for the airlines, the total aircraft fleet involved adds to something less than 2,000 aircraft. Include the foreign airline operations and the figure rises to 4,000 or more.

But even with dual installations and spares, this does not represent a really large business potential compared with that posed by the 60,000 itinerant aircraft now in operation in the U.S. alone. Although dollar values run higher in airline business, this market does not represent the large-quantity output that electronic equipment firms would like to see.

• Time is biggest problem—Probably the biggest problem in selling airline equipment involves time; it takes too long before a new product can be installed in the world airline fleets. Whether it be VOR, DMET, radar beacons or flight recorders, first installation after an ARINC characteristic has been adopted usually comes in a few new aircraft just being purchased by carriers. Retrofit programs usually are unlikely at least in the early stages of implementing a new development.

The past record of delays in introducing new electronic systems speaks for itself. New VOR ordered by one airline years ago wound up in a warehouse for months when the ground facilities fell behind schedule. The DME program was set back by the Tacan squabble and is now awaiting CAA installation of facilities. Radar beaconry has been beset by numerous problems, each delaying the program and market development of the equipment.

In short, it is clear that a set manufacturer developing a new piece of electronic gear probably would starve to death before he would get sufficient production and income if he has to depend on the airlines to eat.

Characteristically in the past, airline business came in dribbles of small orders. It may take several years before orders mount to make the production profitable. The problem, for which a solution is beginning to show, has been one of tiding the manufacturer over during the early "lean" years while the airlines are getting their implementation programs underway.

• Itinerant aircraft business helps—This is where the itinerant aircraft business is beginning to help not only the carriers and set manufacturers immensely, but is attracting new interest in AEEC to make ARINC equipment characteristics more compatible with the needs of the larger business transport market.

Some systems, such as weather radar, are picked up quite rapidly by the bigger executive aircraft operators in the U.S. In these operations safety, reliability of schedules and flexibility of operations are highly important and, as a result, money is no problem in securing the highest quality electronic gear.

Where an airline might install only dual VOR, an executive aircraft operator may install three to sidestep the problem of having an array of field spares situated around the country. Operating weight usually is far less an issue than with airlines thereby permitting the operator to write his own ticket as to how much electronic gear he wants.

This novel situation for executive transport operators is fast making them the ideal first market for airline equipment while a manufacturer is gearing his production for later airline quantity orders. And the installation schedule of an itinerant operator buying electronics equipment in most instances is much faster than anything an airline could achieve.

• Executive operators benefit too—But business aircraft adoption of ARINC type equipment does not benefit only the airlines and electronics firms. Executive operators share equally in the results, not only by benefitting from the engineering and maintenance coordination of AEEC, but by improved operational features that result.

Every manufacturer sooner or later will make a design error in new electronic gear. But with the feedback of service information and pressure applied by competitors of that manufacturer, the product will get "debugged" and a correction will be made in short order.

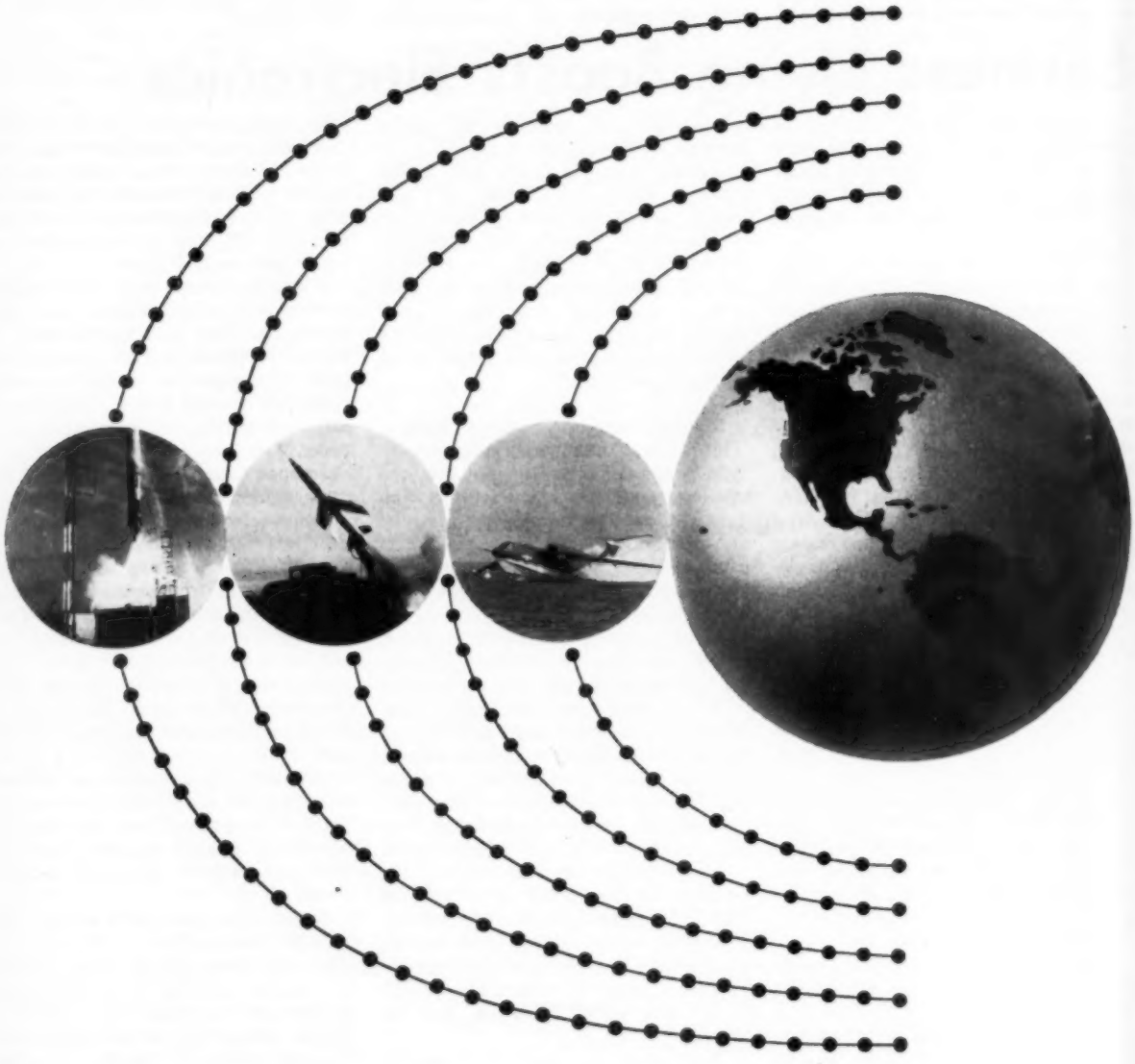
In such instances, airline use of the same equipment as business transport automatically assures correction of problems without the itinerant operators as a group lifting a finger. The manufacturers of airline equipment continually issue service bulletins on their devices and it is safe to say that few of these ever would have been forthcoming if it hadn't been for pressure from airlines using the same type of equipment in extensive flight operations.

The next big advantage, as ARINC sees it, is the benefit that business aircraft operators get from the immense amount of systems planning that goes into each ARINC equipment characteristic.

A good example: Early airline VOR receiver planning back in 1945-47. Carriers then recognized the need for 100 kc channel spacing at a time when government, manufacturers and other groups had no idea so many additional channels would be needed at a later date.

This planning led to adoption of a decade channel selection arrangement, crystal controlled receivers and some really advanced thinking in receiver circuitry.

Today the corporation aircraft pilot is reaping the rewards in VOR equipment with a very long life expectancy. Manufacturers of typical itinerant aircraft gear found their units sadly lacking in channels and tuning flexibility



. . . Business flying

that made their equipment very difficult to use.

And the cost savings to the business aircraft operator can be sizable when buying airline equipment simply because a bigger market can result in a price far less than if he used itinerant-type gear exclusively. There are disadvantages, weight as an example. For the larger corporation aircraft this is no problem, but in the case of smaller twins, the airplane simply may not have the space and load capability for use of airline-type gear.

The trend here, however, is toward solution with the introduction of much smaller, lighter airline equipment.

Pilots benefit early and effectively from AEEC planning. A busy pilot in a high-density area finds decade tuning of VOR a lifesaver and timesaver. He has no need to "hunt and fish" for a given station. If he sets his frequency selector to the proper "numbers," his equipment will be tuned accurately to the desired frequency channel.

There are these operational advantages to use of airline equipment by business operators, but there are minor disadvantages, too. These, however, can be overcome.

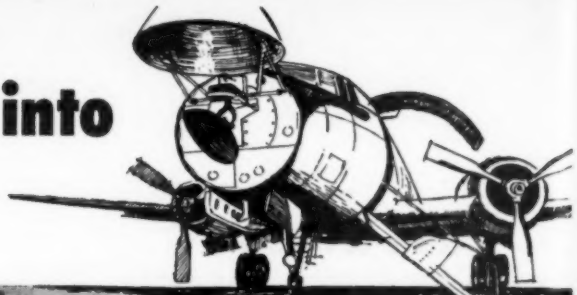
—Where AEEC Came From—

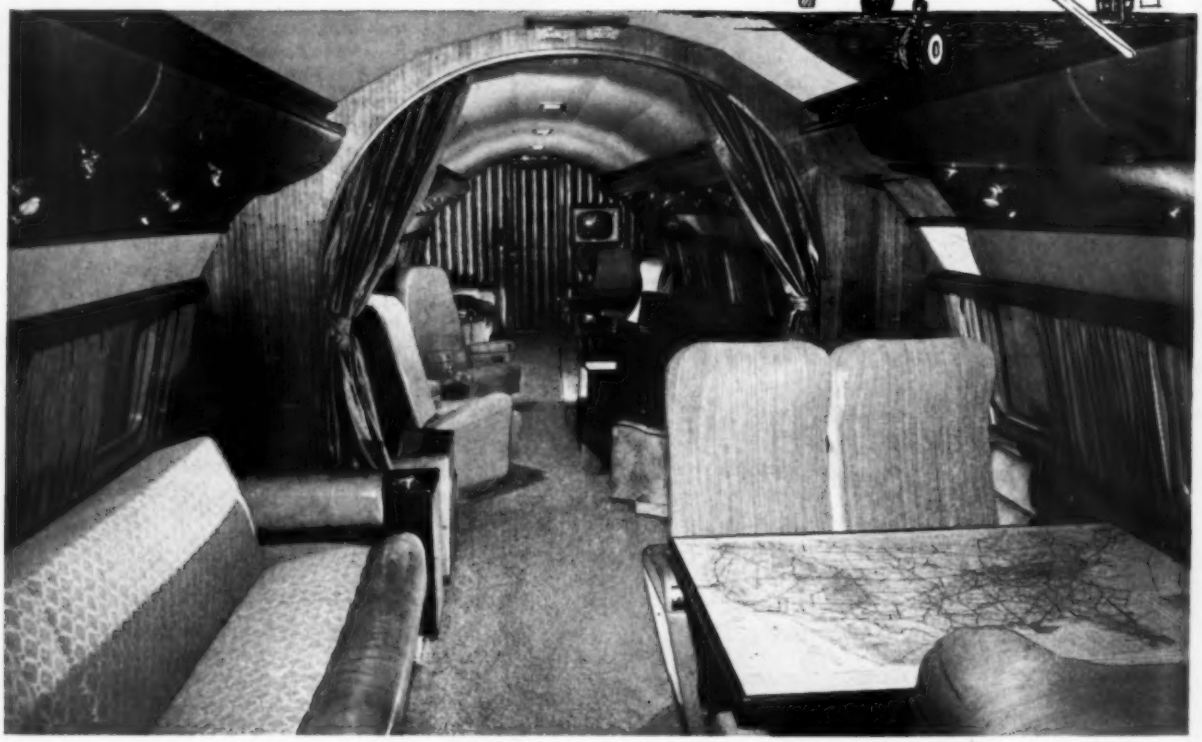
AEEC as it is organized today dates back to 1949, but its true origin lies in earlier attempts at airline industry coordination through ARINC. As early as 1939 a full-time radio engineer was authorized on ARINC's staff to develop industry specifications for electronic gear and to contract for development and production of equipment. Although World War II intervened, this early start produced specifications on HF communications gear, VHF communications transceivers, glide slope, localizer and VHF-range receivers. Although generally attributed to World War II, these were actually civil developments spearheaded by ARINC several years before the war.

In July, 1949 ARINC set up an Aircraft Radio Committee with an airline chairman and nine members. Its posture was strengthened in 1946 by assignment of a full-time ARINC engineering chairman and its name changed to the Aircraft Radio Equipment Committee.

With the postwar growth of electronics firms in the U.S. and shifting airline policy in ARINC on central procurement of equipment, AREC was dissolved in February 1949. Three months later, on May 17, 1949, ARINC's board of directors established AEEC essentially as it exists today.

Converting Convairs into business offices





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Time For Decision: Two Seconds

In that fleeting instant, jet pilots must make right decision, so airlines are seeking new takeoff monitor

By George Hart
Technical Editor

The imminent introduction of jet transports is revolutionizing pilot decision-making on takeoff.

Pulling a 285,000 lb. Boeing 707 or Douglas DC-8 off the ground two seconds too early could result in a 20-25% loss in initial rate of climb.

Two seconds too late and the big jet could roll 500 ft. beyond where it should become airborne.

How will pilots react to this split second operational requirement? That is the question facing airline operations officials and engineers. And with a lucrative market available to the one finding a solution, no fewer than a dozen manufacturers are jockeying for position to sell a takeoff monitoring device.

Here are some of the questions being posed:

What are the factors that must be considered in the design of such a "Go-No-Go" device?

What are the advantages and disadvantages of the various approaches which may be used in development of a "Go-No-Go" system?

Many people have aired their answers to these questions, and several have backed their opinions with solutions to the problems involved. One of these is Harold Hoekstra, a CAA engineer, who has applied for a patent to cover a device he has developed.

First, says Hoekstra, the need for a "Go-No-Go" device has been growing as the takeoff speeds and ground run distances of transport aircraft have been increasing. Since jet engines are affected by temperature conditions and airfield altitude to a greater degree than are piston engines, the need for this type of device has become particularly critical as the high-performance, turbine-powered transports near introduction to airline service.

According to Pan American World Airways, there are only three airports in the eastern United States with runways adequate for takeoff of the big jet transports at maximum gross weight under the most adverse anticipated ambient conditions. These are New York International, Baltimore Friendship and Greater Pittsburgh. At the European end of a transatlantic run, London and Frankfurt have the only satisfactory runways. In between there are only Santa Maria in the Azores and San Juan, Puerto Rico.

It becomes obvious, then, that the jets will be runway limited more often than past or present transports. The existence of a suitable takeoff monitoring system could have a significant effect on the safety and economics of jet transport operation.

• **What should it do?**—To be acceptable, a "Go-No-Go" device should indicate clearly and continuously to the pilot actual vs. required takeoff progress. In other words, most pilots agree that a system which would, for example, merely flash a red light in the event that a takeoff should be aborted would not be adequate. In addition, the following items are considered to be of prime importance in the design of an adequate system:

• It should be accurate within limits of other takeoff variables. Presently, airspeed indicators are required to have an accuracy of ±3%, and this tolerance became Hoekstra's target in the development of his own system.

• It should be possible to check system operation before takeoff.

• Cockpit presentation should be closely associated with the airspeed indicator.

• It should take account of temporary decreases in acceleration rate, due to such factors as puddles, snow patches, etc. on the runway.

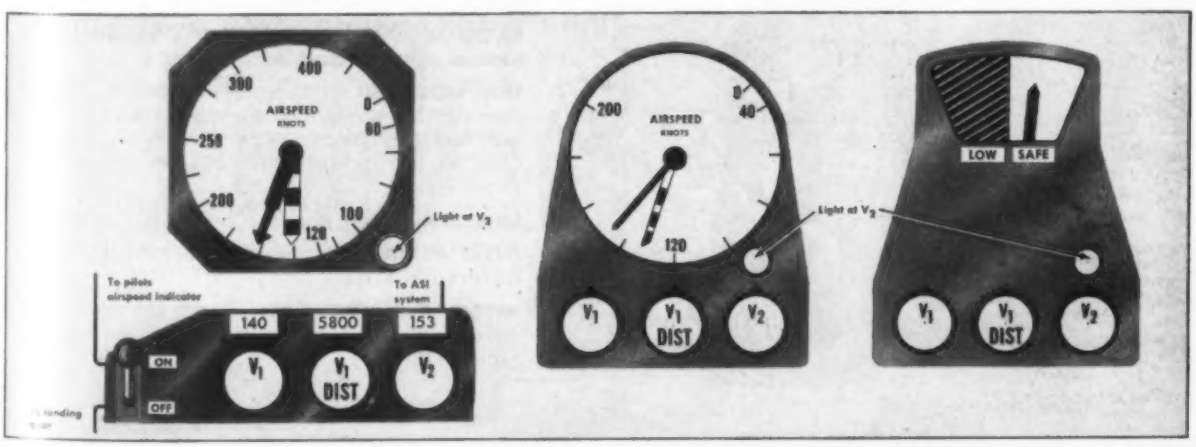
Hoekstra suggests that, in addition, a takeoff monitor should indicate attainment of critical-engine-failure speed (V_1) and takeoff safety speed (V_2) or nose rotation speed (V_R). But, above all, he believes that the device should operate on the basis of velocity vs. distance and not velocity vs. time.

The reason for Hoekstra's preference for an indication based on speed-distance factors is that, although a speed-time system would be mechanically simple, any computation of time must be based on distance.

Hoekstra has analyzed the various methods considered workable. Here's how he has sized up the situation:

An accelerometer device biased with airspeed sensing would be fairly simple mechanically, and it would require minimum programming prior to takeoff. However, difficulties to overcome would involve:

• Reducing sensitivity to runway roughness and pitch change effects. Nose pitch-up of 1° during takeoff of a jet transport with a .25:1 thrust/-weight ratio would result in an indication of 7% more acceleration than actually exists. It would be necessary



ALTERNATIVE takeoff monitoring indicators developed by CAA engineer Hoekstra are modified standard airspeed indicator, secondary ASI, and simple progress indicator. Weight is given as three to four pounds depending on method used.

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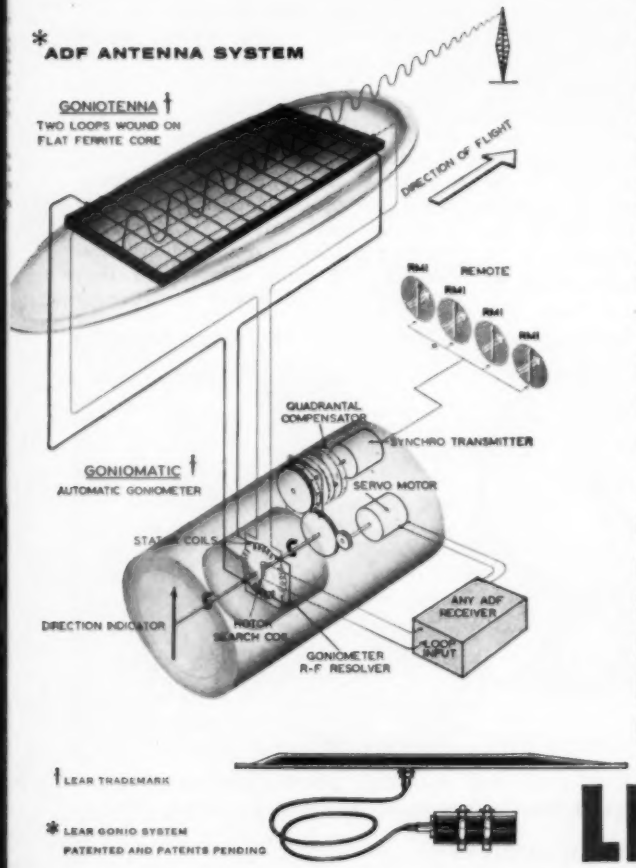

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. . . Jet takeoff decisions more critical

to stabilize the accelerometer monitoring arrangment in some manner.

• Incorporating the ability to distinguish between temporary and significant reductions in the rate of acceleration.

• Development of proper indications to the pilot. Usually, the display used with this type of device is not associated with the airspeed indicator.

• Addition of V_1 and V_2 indications.

• Provision of distance information.

• Provision of means for checking prior to takeoff.

The principle of using a "line speed" check wherein, during takeoff, the pilot checks his speed when he passes a given distance marker probably is the simplest approach of all. No mechanism is involved whatsoever. But the difficulties with this method include:

• The distraction to the pilot in having to look out of the cockpit at right angles to the direction in which he is heading and, worse, away from the airspeed indicator against which he is checking distance covered. At jet transport takeoff speeds, one second represents more than 200 ft. of runway traversed. Hardly ideal conditions for checking markers.

• Identification of markers under night and low visibility conditions, snowbanks, etc.

• Possible confusion due to "distance used/distance remaining" marking procedure. Some countries mark runways in feet, some in yards and others in meters.

• Absence of V_1 and V_2 speed indication.

The speed-time check is similar to the "line speed" check but in this system the pilot notes the time taken to reach, say, 100 kts. compared with the time it should take. The advantages here are that pilots are relatively familiar with this method and no new instrumentation is required. However, the disadvantages are that:

• The pilot is not given continuous information on how the takeoff is progressing.

• Again, there is no indication of V_1 and V_2 or V_R speeds.

A speed-time indicating system with a pointer added to the airspeed indicator and driven to a time-sensing means has the advantage of being simple. At the same time, it gives the pilot a continuous reading of "how goes it" right on the airspeed indicator. When properly programmed, the time needle should stay even with or slightly behind the airspeed needle on a normal takeoff. But, Hoekstra figures:

• If you make a 1% error in programming of the time needle, you've got over 4% error in distance covered.

A ground-based velocity-distance takeoff monitoring system would, in all probability, have the advantage of being highly accurate. With this type of system, Doppler or some other form of radar is used to measure the position of the aircraft as it accelerates along the runway. A computor continuously compares this information with programmed data including type of aircraft, weight, ambient conditions and other variables. Because progress information can be relayed to the pilot by means of lights at the side of the runway, another advantage of this approach is that no equipment is required in the aircraft. However, problems to be overcome here are:

• High cost of equipment—reportedly about $100,000 per runway.

• Pilot reluctance to depend upon ground personnel—as with the old GCA-ILS dispute.

• **The Hoekstra approach**—Last on the list is the approach which Hoekstra has elected to follow. This is an airborne velocity-distance "Go-No-Go" device using the landing gear as part of the distance measuring system. If the aircraft were equipped with Doppler or similar distance measuring equipment, this could be used instead of the landing gear. The advantage

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. . . Jet takeoff decisions more critical

here is, of course, that the pilot is provided with takeoff progress information based on a continuous, direct reading of distance traveled.

However, Hoekstra is the first to draw attention to the difficulties to be overcome with this type of device, particularly if Doppler or the like is not carried in the aircraft. These include:

- Requirement for connections to the landing gear.
- The effect of variations in tire pressure and aircraft weight on the roll radius of the tire.
- The effect of increasing aerodynamic lift on the roll radius as airspeed increases on takeoff.

One other problem which must be overcome with any takeoff monitoring system is that of proving its accuracy to the crew. If inputs into a system are applied too conservatively, loads will be limited or takeoffs will be aborted unnecessarily. On the other hand, if takeoff information is programmed unconservatively, safety would be jeopardized.

• **Sources of inaccuracy**—One of the first things Hoekstra did when he set out to develop a "Go-No-Go" device was work out what degree of accuracy he could expect in measurement of distance through the landing gear.

In actual measurements at Washington National Airport, he found that variations due to tire pressure and wear averaged ±.63% with large aircraft such as Douglas DC-7s and Lockheed 1649s. He concludes that, with reasonable care in tire inflation, accuracy in distance measurement with the jet transports should be maintained within ±1%. Actually, he feels that more care will be taken with tires on these aircraft due to their higher ground run speeds.

As far as variation in distance measurement due to aircraft weight changes is concerned, Hoekstra has deduced from his measurements that the roll radius of a tire changes with variations in aircraft weight proportionately to the change in V_2 speed. He finds that in the case of a typical jet transport 17.00-20 in., 20-ply tire at 120-psi pressure, roll radius of the wheel and tire increases with a reduction in gross takeoff weight about one third as rapidly as V_2 speed increases.

By biasing the distance measurement system through interconnection with the V_2 adjustment, he concludes that accuracy may be maintained in spite of aircraft weight changes.

Distance measurement variations due to aerodynamic lift are constant and can be predicted from test flight data. Hoekstra has designed his "Go-No-Go" device so that this factor is automatically compensated. He has proposed that the distance measuring part of the programming unit be driven at the landing gear through a synchro mechanism. The programmer allows for the fact that, as lift increases, distance covered by each rotation of the aircraft's wheel also increases.

• **Method of operation**—To operate the device, the pilot must determine V_1 speed, V_r distance and V_2 or V_R speed as applicable from the aircraft operating manual used in pre-flight planning. These values are set with the adjusting knobs on the programming unit which is small and can be mounted on the console in the cockpit.

Takeoff progress, based on distance, could be indicated in several ways. Hoekstra's design calls for modification of a standard airspeed indicator so that the maximum airspeed hand, not normally used during takeoff will act as a "pacer," being driven from the programming unit by a synchro mechanism. The programmer mixes actual and required takeoff distance information to provide a reading of required takeoff performance.

When taxiing out, the device can be switched on for a functional check. The maximum airspeed needle should start to travel around the dial of the airspeed indicator. When in position for takeoff, it is reset to zero. During takeoff, as long as the airspeed needle is level with or ahead of the maximum airspeed needle, progress can be considered satisfactory.

Indication of the attainment of V_1 speed is accomplished by permitting the "pacer" hand to swing over to its normal function at this point. When V_2 speed is reached, an aneroid bellows connected to the aircraft's airspeed indicating system actuates a switch to operate a light on the airspeed indicator.

In case the operator does not wish to modify standard airspeed indicators, Hoekstra has proposed alternative indicating systems. One involves a secondary airspeed indicator which the pilot would use during takeoff and initial climb. The other calls for a simple presentation to indicate progress but not airspeed. The programming unit is integral with these indicators; however, this is optional. In either case, the indicator could be mounted by itself on the glare shield where it could be watched by the pilot with a minimum of diversion of attention from the runway. It would be small enough not to obstruct his view.

MS (STANDARD)

For Aircraft, Electronic Instruments, Military, Industrial, and Commercial Applications

Standard MS-A, MS-B, MS-C... meet Specification MIL-C-5015C. **Plastic inserts.** 15 diameters, 260 insert layouts, 6 shell styles. MS3100 to MS3108 with all accessories. Interchangeability an outstanding feature. Many type assemblies directly available through distributors.

connect with CANNON PLUGS

MS-E (INT. AN-M)

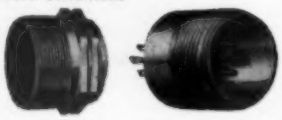
Where Vibration Resistance and Moisture Proofing Are Needed

MS-E Series... environment resisting. Meets Specification MIL-C-5015C. Resilient inserts. Completely sealed from cable to cable. Integral clamp and bushing. Grounding lugs. Interfacial sealing with grommet and grommet follower.

The "MS" and associated series connectors offer the

GS (HERMETICALLY-SEALED)

For Use Under Critical Pressure Conditions



Hermetically sealed connectors... with steel shells and contacts to withstand high pressures. Available in GS (MS type), KH, RKH, U, BFH, TBFH. Insulation is Canseal glass material, fused under high temperature to shell and contacts... giving *true hermetic sealing* when soldered or brazed to housing.

STEEL SHELL FIREWALL

For Open Flame Protection Wherever High Temperatures Are Involved

MS-K and Cannon FW Firewall Connectors... offer you the greatest variety of this type of connector. Cannon made the first firewall connector and continues the leader in the field. Wall—or box-mounting receptacles. Straight or angle 90° plugs. Crimp-on contacts. Inserts of asbestos-filled or glass-filled materials.

CONNECTORS SUITABLE FOR POTTING

For Resistance to Moisture, Fuel Oil, Gasoline, etc.

CA06 and CA3106 Types... developed for the Bu Aer Standard MS3106 type minus the end bell. Special plastic "cups" supplied for use as a mold while potting the rear of the connector. Weight saving. Grounding means available. Plastic or resilient inserts.

widest selection of types for all applications to Spec. "MIL"

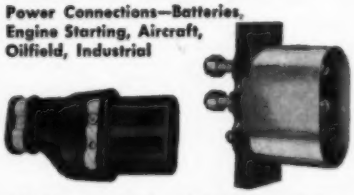
AF, F (VIBRATION PROOF)

For Points of High Vibration Where Extra Strength Is Needed

Vibration Proof CA310*F Solid Shell, Resilient Insert Connectors... Feature extra strong coupling nuts... in hex, spline, knurled types for airline use. In wall—or box mounting, cord-connecting type receptacles. Straight or angle 90° plugs.

AN EXTERNAL POWER

Power Connections—Batteries, Engine Starting, Aircraft, Oilfield, Industrial



CA2551, AN2552, AN3114 and Other Cannon Types Offer Most Complete and Varied Line... in single, double, and three contact fittings. Really rugged! Designed and built for safe, positive connection and long-lasting service.

MS ACCESSORIES

Cable Clamps, Conduit Fittings, Dummy Receptacles, Junction Shells, Dust Caps, Bonding Rings, Bushings, Adapters

Featuring High-Quality Materials and Workmanship... including AN3057, AN-3057A, AN3420, AN3054, AN3055, AN30-56, AN3058, AN3064, AN3066, AN3068, AN3111, 2120, 2245, 17530, 2209, 2182. Adaptable to all makes of MS connectors.

Cannon Plugs—standard of quality for the industry

W

For Underwater and Severe Moisture Conditions

W Waterproof Series... used underwater and on equipment operating in swamps, rivers, lakes, with underground cables—wherever conditions require thoroughly sealed fittings. Exceptionally rugged. MS type inserts. Acme threads on coupling nuts. Special rubber sealing ring. Special heavy duty cable clamp available.

OTHER SERIES... Audio Types—External Power Connectors—Switching Types—dc Solenoids—Guided Missile Launching Connectors—Miniatures and Sub-Miniatures.

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AIRTRENDS

The only question remaining about the Federal Aviation Agency concerns its director-to-be. Best-informed guess is that Elwood R. Quesada, the President's special assistant for aviation matters and chairman of the Airways Modernization Board, will be the recess appointee. FAA will not actually come into being until 60 days after the new director takes his oath of office. It will absorb the Civil Aeronautics Board and AMB, and will take over the safety rule-making and enforcing powers of CAB.

Almost forgotten as Congress wound up was the fact that Eisenhower had pushed through his Pentagon reorganization bill despite powerful opposition of Rep. Carl Vinson (D-Ga.), chairman of the House Armed Services Committee, and others. Here's what the bill does:

(1) Puts the Secretary of Defense in direct command of the armed services, dropping the secretaries of the Air Force, Navy and Army from operational chain of command. They retain their administrative functions.

(2) Gives the Secretary authority to assign weapons and services virtually as he sees fit.

(3) Gives the Joint Chiefs of Staff direct operational authority, enlarging the JCS general staff from 210 to 400 officers.

(4) Places in direct control of all research and development a new director of research and engineering, responsible to the Secretary.

•

Reorganization will be painfully slow. Major job will be to find the right man to head the new office of Director Research, Engineering and to rewrite "function" papers which will transfer control of unified and specified command from the control of the Service Secretaries acting as executive agents to the Secretary of Defense.

Another major headache—this time for the Army, Navy and Air Force will be to decide which of its assistant secretaries are to be declared "surplus." Afterwards there will have to be a major realignment of organization to fit the changes made at assistant secretariat level.

Senate hearings on aviation insurance practices ended rather unexpectedly after shedding little light on subject. Senate Antitrust and Monopoly Subcommittee heard testimony which centered around the adequacy of state supervision of aviation insurers and the insurance problems of airport operators. Sen. Joseph O'Mahoney (D-Wyo.), chairman of the subcommittee, warned that his investigation aims at "some form of public regulation."

One unpublicized provision of the Federal Aviation Act of 1958 (formal title of the bill creating the FAA) is that it requires an exchange of information among the Administrator of FAA, the Secretary of Defense and the Administrator of the National Aeronautics and Space Administration. They are directed to establish by cooperative agreement "suitable arrangements for the timely exchange of information pertaining to their programs, policies and requirements directly relating to such responsibilities." This provision was not in the original draft of the bill (S. 3880) introduced in the Senate by Sen. A. S. (Mike) Monroney (D-Okla.), father of the new agency.

•

As the bill finally arrived on the President's desk for signature, it revealed that the new FAA Administrator would have at his disposal one of the most politically desirable posts in the federal government. For example, he may fix the compensation for ten positions, subject to the civil service and classification laws, at rates "not to exceed $19,500 per annum." Also, he is authorized to establish and fix the compensation for "15 positions of officers and employes of the Agency of a scientific or professional nature without regard to the Classification Act of 1949.

Congress also did something about the recurrent charges of poor morale in the armed forces resulting from low pay and inadequate incentives. It passed a military pay raise bill that rewards initiative and special skills of enlisted grades and substantially raises the pay of top-ranking officers.

AIRTRENDS

Federal Aviation Agency, when it takes over the reins, will have its hands full of mandates from Congress on airport and air traffic control topics. House Legal and Monetary Affairs Subcommittee has set down no fewer than six specific areas for CAA to act, but FAA presumably will take over before action can get underway. Key points made by House group:

(1) New vigor and a better pipeline are "musts" in getting planning information to airport operators. (2) CAA studies on segregation of military jet activities from civil operations should be accelerated. (3) Cockpit visibility standards should be revised. (4) Restricted areas of airspace should be reevaluated. (5) CAA should revise airport runway length standards to cover oncoming jet operations. (6) Inequities of air traffic controller job standards should be corrected.

CAA also bore the brunt of criticism from another source at presstime as CAB released its findings in the April 21 Nellis AFB collision of a United DC-7 and USAF F-100. Board charged CAA and USAF with failure to take necessary control measures to preclude the mishap despite earlier reports from UAL of near misses in that same area. Strong language prevailing throughout report obviously reflected Board and staff response to criticism of its nebulous conclusions in past investigations involving Grand Canyon and Pacoima, Calif. collisions. In both instances CAB found "the pilots didn't see each other."

In the Nellis report CAB states flatly that CAA exercised poor judgment in failing to correct conditions existing on the airways which impaired visual collision avoidance and created unnecessary collision exposure. It charged that the administrator was duty bound to bring to its attention the existence of a potentially unsafe situation such as existed at Nellis but that this was not done. In its final statement of a probable cause the Board cited the failure of Nellis AFB and CAA to take every measure to reduce a non-collision exposure commenting that many of the actions initiated after the accident could reasonably have been taken before it occurred.

Dispute over runway layout for new Chantilly (Washington, D.C.) airport may have been resolved between CAA and Air Transport Assn. but issues involving basic design of an airport for jets are smoldering. Critics persist that CAA plan will be unworkable with jets, is wasteful of acreage and has no reasonable provision for expansion without aggravating an already bad situation. Their prediction: a "white elephant" at Chantilly.

Move to Chantilly will force National Bureau of Standards to move out. Part of the NBS equipment will be shifted to the Boulder Laboratory. However, other parts of the equipment must stay on the East Coast, and must be free of the radio interference which will result from airport operations. Decision on where to move NBS hasn't been made. Cost of the move (an indirect result of Chantilly) will be financed in a supplemenal appropriations bill.

Acceptability of jet noise levels at New York still remains the key to successful turbine operations. in both domestic and international operations. Results of recent Comet 4 noise tests at Idlewild Airport aren't expected for another two weeks, although its transatlantic introduction is only slightly more than three months away. And Boeing 707, slated to enter service about November 1, is still restricted at Idlewild to 190,000 lb. gross weights among other special operating conditions.

Airways Modernization Board is wasting no time getting a feel for the real scope of military air traffic operations. USAF, Navy, Marines and Air National Guard units over the weekend (Aug. 21-24) recorded all local flights in the U.S. Army, too, is participating but not on the same dates. AMB already has collected data on cross-country military flying, will use data as part of study by management consultants Booz, Allen and Hamilton (AMERICAN AVIATION, Aug. 11, p. 19).

Lockheed Aircraft Corporation, in co-operation with Shell, developed *new fuel techniques* to speed the servicing of the *Electra.*

Short stop for first U. S. Prop-Jet

LOCKHEED'S NEW ELECTRA . . . first U. S. prop-jet airliner . . . has such advanced design features that ground service time has been cut to only 12 minutes.

AeroShell Turbine Fuel, used extensively by prop-jet aircraft flying in the U. S. today, was selected for the proving flights of the *Electra.*

Shell trucks, specially designed to service this new airliner, deliver over 300 gallons of AeroShell Turbine Fuel a minute. Fuel is pumped aboard into all four wing tanks *simultaneously* through a new Lockheed single-point fueling system.

Shell's research in aviation aircraft fuels has always kept pace with aircraft development. Perhaps this is why the Shell fuel truck is such a familiar sight at airports everywhere.

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"FUELING THE ELECTRA"

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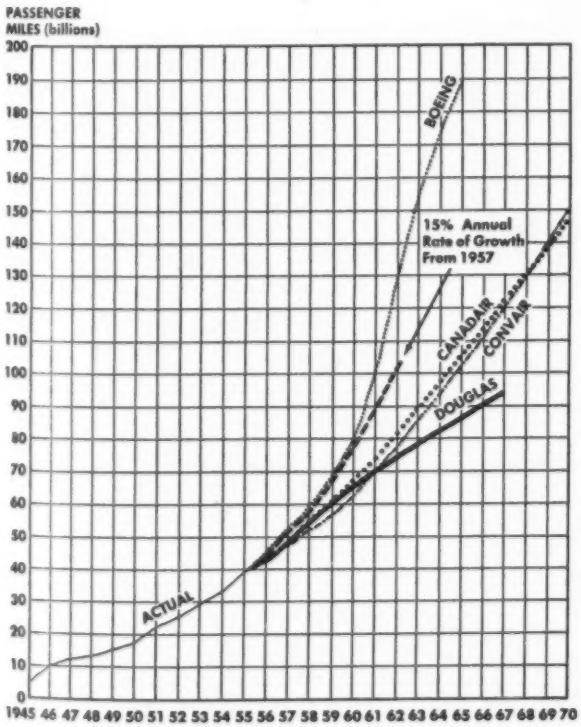
AIRTRENDS

IATA's controversial study on "The Economic Implications of the Introduction into Service of Long-Range Jet Aircraft" proved to be something less than sensational when issued earlier this month. Not only does ICAO itself say in an accompanying press release that the staff report was neither "adopted nor endorsed," but the text itself is sprinkled with disclaimers.

"Many attempts have been made to estimate the future demand for air transport, and almost as many different results have been obtained," the report notes. (Several of these forecasts are plotted on the graph below, which is taken from the ICAO report.)

Although the report does not make any important new contribution to the many jet age questions, it does contain a number of very provocative assumptions. One of these is that accident attrition will reduce the present aircraft fleet by 2% per year. Another is the assumption that except for accidents, all other transport aircraft will continue in service and this portends a major surplus of seating capacity as soon as the jets are added.



Who persuaded the Post Office Department to change course and oppose certification of an additional mail carrier on the transatlantic run? It was expected that TWA and Pan American would oppose Seaboard & Western's application for authority to carry mail on its transatlantic route, but not the post office. Seaboard says a large percentage of mail is available for movement out of New York at times which are not generally used by passenger flights. As an all-cargo carrier, Seaboard believed it was in a better position to carry mail than combination carriers. TWA and PAA have taken the position that there is no need for an additional carrier. The post office agreed.

Stormy petrel in the recent controversy between the CAB and United Air Lines, Robert L. Kunzig has been appointed a member of the Foreign Claims Settlement Commission. Kunzig, executive director and assistant to the chairman of the CAB, was alleged to have threatened reprisals against UAL officials for being critical of CAB in Congressional hearings. Kunzig's new job is for an indefinite period and must be confirmed by the Senate, but no obstacles were anticipated. His CAB assistant, Robert Lester, will act as executive director until a successor is named. Kunzig succeeds Henry J. Clay on the Foreign Claims Settlement Commission.

Continental Air Lines is making the first test of CAB's reaction to the report by Dr. Paul W. Cherington, Harvard professor of business administration, for Presidential assistant Elwood R. Quesada. Continental filed a request for permission to introduce a new "economy" fare on the Chicago-Los Angeles run and at the same time to increase first-class and coach fares by 6%.

CAL made a four-part proposal, one of which was for an experimental daily flight between Chicago and Los Angeles for a one-way fare of $64, using 90-seat aircraft. Box lunches would be sold en route. CAL hopes to draw traffic from coach passengers who now pay $80.50 and the supplemental carriers, who charge $67.50, as well as railroads and buses.

Local carriers have little chance of persuading the CAB to allow more nonstop service between major points. Latest hearing before the Board resulted in issuance of an order denying applications for exemption by Pacific Air Lines for a nonstop Los Angeles/Burbank-San Francisco/Oakland route and a nonstop San Francisco/Oakland-Los Vegas route. Pacific presently operates between the two sets of points with intermediate stops.

The Board said that Pacific has not yet shown any need for additional nonstop service.

Eastbound Revenue Traffic of North Atlantic Carriers

Carrier	Seating Capacity				Revenue Passengers				% Seats Utilized			
	First	Tourist	Economy	Total	First	Tourist	Economy	Total	First	Tourist	Economy	Total
U.S. Traffic												
Air France	8,389	12,175	9,905	30,469	5,573	7,797	6,966	20,336	66.4	64.0	70.3	66.7
Alitalia	1,891	3,140	4,047	9,078	883	1,339	2,616	4,838	46.7	42.6	64.6	53.3
BOAC	13,960	11,785	11,317	37,062	9,120	7,872	9,465	26,457	65.3	66.8	83.6	71.4
Lufthansa	3,268	7,512	8,791	19,571	1,565	3,841	7,047	12,453	47.9	51.1	80.2	63.6
EI Al	1,512	2,259	3,570	7,341	683	1,363	2,968	5,014	45.2	60.3	83.1	68.3
Iberia	1,558	2,430	2,080	6,068	547	1,011	1,120	2,678	35.1	41.6	53.8	44.1
KLM	6,539	10,477	12,411	29,427	3,758	6,756	8,116	18,630	57.5	64.5	65.4	63.3
PAA	30,223	35,930	36,718	102,871	17,132	18,935	25,251	61,318	56.7	52.7	68.8	59.6
Qantas	937	1,160	660	2,757	405	626	322	1,353	43.2	54.0	48.8	49.1
Sabena	4,096	6,622	12,369	23,087	2,519	4,002	9,013	15,534	61.5	60.4	72.9	67.3
SAS	10,572	6,093	18,684	35,349	5,710	3,352	15,154	24,216	54.0	55.0	81.1	68.5
Swiss	3,661	4,277	6,008	13,946	2,728	2,437	4,999	10,164	74.5	57.0	83.2	72.9
TWA	16,014	27,931	26,600	70,545	9,032	14,766	17,649	41,447	56.4	52.9	66.3	58.8
U. S. Total	102,620	131,791	153,160	387,571	59,655	74,097	110,686	244,438	58.1	56.2	72.3	63.1
Canadian Traffic												
BOAC	1,579	4,082	4,580	10,241	989	1,740	3,373	6,102	62.6	42.6	73.6	59.6
Canadian Pacific	1,454	3,445	1,887	6,786	512	2,196	1,565	4,273	35.2	63.7	82.9	63.0
KLM	1,587	2,739	3,584	7,910	807	1,381	2,521	4,709	50.9	50.4	70.3	59.5
TCA	2,870	7,976	6,904	17,750	1,665	5,368	6,438	13,471	58.0	67.3	93.2	75.9
Canadian Total	7,490	18,242	16,955	42,687	3,973	10,685	13,897	28,555	53.0	58.6	82.0	66.9
Grand Total	110,110	150,033	170,115	430,258	63,628	84,782	124,583	272,993	57.8	56.5	73.2	63.4

Westbound Revenue Traffic of North Atlantic Carriers

Carrier	Seating Capacity				Revenue Passengers				% Seats Utilized			
	First	Tourist	Economy	Total	First	Tourist	Economy	Total	First	Tourist	Economy	Total
U.S. Traffic												
Air France	8,746	12,469	9,814	31,029	5,220	8,094	4,549	17,863	59.7	64.9	46.4	57.6
Alitalia	1,944	3,410	3,852	9,206	642	1,923	2,055	4,620	33.0	56.4	53.3	50.2
BOAC	13,960	10,944	11,311	36,215	7,481	7,812	5,848	21,141	53.6	71.4	51.7	58.4
DLH	3,331	7,810	8,558	19,699	1,124	5,442	3,766	10,332	33.7	69.7	44.0	52.4
EI Al	1,440	1,885	3,570	6,895	356	960	2,417	3,733	24.7	50.9	67.7	54.1
Iberia	1,539	2,415	2,040	5,994	281	773	394	1,448	18.3	32.0	19.3	24.2
KLM	6,298	10,004	12,493	28,795	3,178	6,230	4,226	13,634	50.5	62.2	33.8	47.3
PAA	30,716	38,857	32,302	101,875	16,079	21,727	14,325	52,131	52.3	55.9	44.3	51.2
Qantas	908	1,340	520	2,768	214	665	21	900	23.6	49.6	4.0	32.5
Sabena	4,104	7,182	11,643	22,929	1,443	3,623	3,851	8,917	35.2	50.4	33.1	38.9
SAS	10,651	6,623	18,540	35,814	4,166	5,029	8,590	17,785	39.1	75.9	46.3	49.7
Swiss	3,626	4,397	6,008	14,031	1,965	2,764	2,916	7,645	54.2	62.9	48.5	54.5
TWA	15,721	24,204	23,727	63,652	7,906	13,462	9,211	30,579	50.3	55.6	38.8	48.0
U. S. Total	102,984	131,540	144,378	378,902	50,055	78,504	62,169	190,728	48.6	59.7	43.1	50.3
Canadian Traffic												
BOAC	1,604	4,190	4,985	10,779	920	2,966	3,202	7,088	57.4	70.8	64.2	65.8
Canadian Pacific	1,463	3,745	1,742	6,950	379	2,539	1,460	4,378	25.9	67.8	83.8	63.0
KLM	1,612	3,325	3,906	8,843	768	2,462	3,016	6,246	47.6	74.0	77.2	70.6
TCA	2,832	7,928	6,845	17,605	1,497	6,140	5,703	13,340	52.9	77.4	83.3	75.8
Canadian Total	7,511	19,188	17,478	44,177	3,564	14,107	13,381	31,052	47.5	73.5	76.6	70.3
Grand Total	110,495	150,728	161,856	423,079	53,619	92,611	75,550	221,780	48.5	61.4	46.7	52.4

Sparked by the new economy-class fares, air travel across the North Atlantic reached a new peak during the first six months of this year, according to an exclusive AMERICAN AVIATION compilation. Although the new economy service only started April 1, a total of 200,000 travelers chose this class service during April, May and June, as contrasted to the 300,000 who chose to ride first class and tourist during the entire first six months of the year.

All carriers on the Atlantic shared in the increases, but once again Pan American and Trans-World were first and second in total traffic carried. At the same time, the share of total traffic carried by these two U.S. flag lines dropped 42.6%, with foreign carriers capturing some 57.4% of the market. Last year, U.S. carriers dropped below 50% of the market for the first time and the trend is proving most disquieting to Pan Am and TWA.

Another good reason gourmets say:

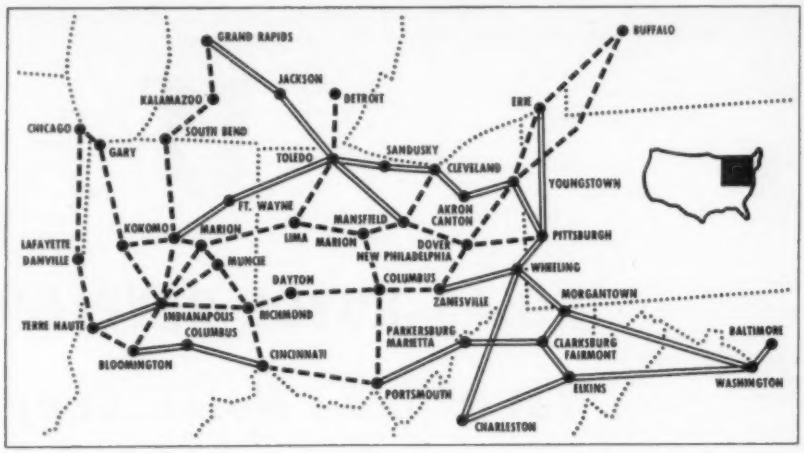
The BEST WAY is by TWA

Dave Chasen, noted Beverly Hills restaurateur, approves a great entree.

Sirloin of beef... broiled to your order in flight!

Your Ambassador flight hums toward the evening sun. Dinner is served—a celebrated event on TWA. You begin with cocktails, you conclude with coffee, a choice of liqueurs, and a satisfied sigh. But the high point, an airline innovation by TWA chefs and Dave Chasen, is a culinary masterwork—a tender cut of prime sirloin of beef broiled in flight to individual taste. All this, of course, part of a most pleasant and rewarding trip by TWA Ambassador.

FLY THE FINEST... FLY **TWA** TRANS WORLD AIRLINES



DOUBLE LINES show new routes recommended by CAB Bureau Counsel for Lake Central Airlines which might solve some of its problems. New routes would increase present coverage (broken lines) by one-third.

Employe-Owned Airline Has Troubles

By Eric Bramley

INDIANAPOLIS—Lake Central Airlines is a local service carrier with lots of problems—and a lot of promise.

It seems safe to say that no other local carrier has had more problems. In view of its handicaps, it's surprising that LCA has done as well as it has.

The "world's only employe-owned airline" has operated for the past six years with all its stock in a voting trust and with a cloud of litigation hanging over its head. These factors have made it impossible to do two things: secure badly needed financing and offer more service to the public.

LCA's growth has been steady, but it still ranks 12th among the local lines in passenger-miles. Operating 2,281 route miles, serving 33 cities through 29 airports in six states (Indiana, Ohio, Illinois, Michigan, Pennsylvania and New York) with a population of 13 million, its ranking would undoubtedly be higher were it not for the handicaps.

To understand LCA's problems, a thumbnail history is necessary. The company started as Turner Airlines (Roscoe Turner, president) on Nov. 12, 1949, with a DC-3 flight over the 232-mile Indianapolis-Grand Rapids route. Because of conditions at intermediate fields, Beech Bonanzas were used on routes from Indianapolis to Cincinnati, Louisville and Chicago. DC-3s were put on these services later.

• Placing stock in trust CAB's idea—The Weesner interests controlled the company by virtue of planes and money they had put into the operation (John Weesner served as president for a short time). They also operated Nationwide Air Transport Service, a nonscheduled carrier, and the CAB became unhappy about their interlocking interests. At CAB's suggestion, the LCA stock was placed in a voting trust.

The Weesner family then signed a contract to sell its 97% LCA stock interest to North Central Airlines. After two years during which the contract was not consummated, the Weesners gave LCA's employes an option to buy their holdings, subject to the prior rights of North Central, if any. In early 1955, this option was exercised and the employes picked up 97% of the stock.

The employe group went to court, claiming that North Central had breached the contract. U.S. District Court ruled for the employes, but the Appeals Court reversed the decision in favor of North Central. CAB then ruled that a North Central-LCA merger was not in the public interest. North Central has taken this decision to the U.S. Court of Appeals, which has not yet acted. Inasmuch as CAB's vote was unanimous, LCA is optimistic.

Thus, with ownership undecided, the airline has been unable to move in any direction. The stock is still in a voting trust, with J. J. O'Connell, former CAB chairman, as voting trustee and board chairman. The employes, of course, would be forced to dispose of their stock should North Central eventually win.

LCA is now under the leadership of Gwin Hicks, who took over the presidency in 1955 from Dr. R. B. Stewart, of Purdue University. Hicks, a 27-year veteran in aviation, was an organizer of Empire Airlines, which merged with West Coast Airlines, and served as its vice president for several years.

• $300,000 debentures being sold—LCA's paid-in capital is a very low $217,838. Although badly in need of financing, it has not been able to try a stock issue because of the litigation, and issuance of debt securities was not considered feasible. At present, William Blair & Co., Chicago underwriter, is selling $300,000 of LCA 6% convertible subordinated debentures. Blair is handling the issue on a "best efforts" basis for 1 2/3% commission. Conversion of the debentures is not optional—if LCA wins in court, these securities must be converted into common stock at $3 a share. If LCA loses, the debentures may be called.

If the issue sells out, as expected, the company will try to secure additional cash through bank loans secured by its airplanes and through long-term notes. Of the $300,000 debentures, incidentally, $200,000 will be used to retire outstanding accounts payable. The airline is now on a temporary mail rate and last year received $1,737,241 in subsidy and $44,415 in mail pay.

LCA isn't helped by the fact that it has trunkline competition on several of its routes—Columbus-Dayton, Dayton-Indianapolis, Chicago-Indianapolis and Columbus-Cleveland, for example. On the 162-mile Chicago-Indianapolis route, it will consistently fill airplanes from Chicago to the intermediate Lafayette, Ind., but not to Indianapolis. Even more competition comes from high-speed highways.

And to competitive or even noncompetitive points, LCA must operate in an ultra-conservative manner, sticking to a minimum frequency pattern of two roundtrips daily, adding a third only if it's certain the new trip will pay for

ROLLS-ROYCE DEVELOPMENTS

Jet Engine Noise Suppression

Rolls-Royce have been actively developing jet noise suppressing devices since 1950, and have accumulated a wealth of experience in the development and production of aircraft carried noise suppression systems.

Corrugated nozzles developed by Rolls-Royce, which are in production for use on the Avon engines of the de Havilland Comet 4, achieve a reduction of five decibels in the noise level of this aircraft with a penalty of less than one per cent in overall performance, and have accumulated more than seven thousand hours in flight in Comets alone. With these nozzles fitted, the Comet 4 is quieter in operation than contemporary large piston engined aircraft.

Rolls-Royce are also developing noise suppressing nozzles for the Boeing 707-420, powered by four Rolls-Royce Conway by-pass turbo jets.

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itself. It can't gamble on adding a trip to try to develop traffic, because CAB might later disallow the expenses for mail rate purposes if the load factor fell short. No capital is available to absorb such risks.

The company, its officials say, is also hampered by restrictions—it has eight route segments and cannot overfly the terminal of any segment. This cuts down on flexibility of schedules. It inherited a number of castoff trunk routes and stops that need straightening out.

The average length of hop is 72.8 miles (local industry's average, 83.8) and average length of a passenger's journey is 157 miles (182 average). What's needed, the company says, is broad skipstop or nonstop authority, and the lifting of restrictions on overflying segment terminals.

• **Favored for additional routes**—In CAB's pending Great Lakes Local Service Investigation case, LCA has been favored by CAB Bureau Counsel (examiner's report not yet issued) for additional routes that would increase the airline's size by 33%. Also involved is the reshuffling of certain towns on routes plus broadened operating authority. Needless to say, LCA is awaiting the outcome with considerable interest.

LCA is now operating 10 DC-3s (eight owned, two leased from the Navy at $2,000 a month), with daily utilization of about six hours per plane. It does its own airframe and accessory overhaul, but engines are handled by Dallas Airmotive and propellers by Purdue Aeronautical Corp.

Whether it will need a new airplane depends to a great extent on the outcome of the Great Lakes case, in which route awards and changes could lengthen its hops. The Fairchild F-27 and turboprop Convairs have been studied. A guaranteed loan would probably be sought if new planes were purchased.

The 72.8-mile average hop affects both speed and costs. Even if improvements were made in the DC-3s to increase speed, the benefits would be small, Bob Clifford, vice president-operations, points out that average speed is 134 mph. If this were increased by 10 mph, a 70-mile trip would be shortened only 1½ mins. from 30 mins. to 28½.

He also explains that in instrument weather the company wants to have air traffic control send its flights by the most direct IFR routing under 4,000 ft. if there is no conflicting traffic, instead of by preferential routings. New controllers are more apt to assign aircraft to these latter routings because they are easier for the controllers to handle. But, on a Grand Rapids-Cincinnati flight with three intermediate stops, the direct mileage is 290 against 321 on the IFR primary. This increased mileage adds 10.8% to the cost of the flight and 17 minutes to the time. LCA has been working with CAA on the problem.

Clifford stresses the importance of eliminating ATC delays in short-haul operations. "Our records indicate that when we have a delay at the end of the runway, it will average 10 minutes," he says. "En route and approach delays average 15 minutes. With a 70-mile hop taking 30 minutes, a 25-minute delay adds 83% to the flight time."

• **Resident managers making survey**—In the sales department, vice president Don Getchell recently asked the manager in each LCA city to conduct a survey of his top 10 accounts. Each manager received an interview form. After studying the form, he left it in his office and dropped by for a no-holds-barred, informal chat with each account. The form was filled out later.

When the "top 10" results are compiled, "we'll know for the first time what people really think about Lake Central," Getchell remarks. A preliminary check shows that customers are impressed by the fact that the employes own the airline. There were lots of compliments and no complaints about stewardesses. And there was an "amazing" acceptance of the DC-3, according to Getchell.

LCA's representative in each city is known as the "resident manager," a term the airline believes fits the man who "is put there to run the company's business." He handles sales, is given free rein to make speeches, call on Congressmen and other officials, and is also responsible for operations. These men report to district managers in Chicago, Lima, Grand Rapids and Columbus.

The resident managers don't receive equal salaries. LCA has devised what it calls a 19-point weighted incentive and work compensation wage scale. Management gives weighted consideration to every work factor in determining salary under this incentive system.

If the legal snarls untangle satisfactorily, LCA will be able to do two important things: get money and offer more service. The area it serves is a good one, and Gwin Hicks believes it will become even better as traffic grows between industries along the Ohio River and those developing along the St. Lawrence Seaway. These factors, coupled with the good possibility of getting rid of restrictions, straightening out routes and getting some new routes, can push Lake Central up in the local service rankings.

Aviation Insurance Practices Under Fire

Aviation insurance practices came in for sharp criticism at hearings held earlier this month by the Senate Antitrust and Monopoly Subcommittee. At one point in the hearings, Sen. Joseph O'Mahoney (D-Wyo.) put the industry on notice that the investigation could lead "to some form of public regulation." He said the subcommittee "is not looking for anti-trust prosecutions" and warned the aviation underwriting industry to consider its own reform.

One witness, Paul Brabazon, president of Tele-Trip Co., told the subcommittee about some of the sharp practices used by some of his large competitors.

Brabazon accused the larger companies of cooperating with each other in bidding for airport locations and in providing more insurance than the small companies could offer.

Most aircraft hull insurance rates are set by the Aviation Insurance Rating Bureau, dominated by the Associated Aviation Underwriters, New York insurance officials said. In no case they could remember did the State authorities change a rate set by the Bureau.

—WEST COAST TALK—

By Fred S. Hunter

The last airplane on the DC-6/7 line at Douglas is No. 1041 and it is a DC-7C for KLM. This means the Dutch carrier will have the distinction of operating the last piston-powered transport to be built. Note, we say built, not delivered. Lockheed's Constellation line is already down, although some deliveries are still to be made; Convair has a few 440s, which are completed but still to be sold, and, of course, one of the Douglas customers might not be so prompt as KLM in making the final payment and picking up his airplane. The plane immediately ahead of the KLM DC-7C on the line at Santa Monica, No. 1040, will be the last DC-6B. It is for JAT, the Yugoslavia carrier.

• **Coming up**—What happens next at Santa Monica after the last rollout from the DC-6/7 line? One possibility, of course, is production of the DC-9. Reports already are current that Douglas is making plans for the release of work orders for Jan. 1, 1958. Everybody seems sure Douglas will go ahead on the short-range jet, but there is no confirmation that a decision actually has been made. Douglas has, however, decided on the the configuration of the DC-9. It would be a 72-passenger, 2,000-mile range, 125,000-pound gross weight aircraft powered by four P&W J52 engines for first flight in 1961 and delivery in 1962, subject to conversion to turbofans later.

• **Airfreighter** — Lockheed's CL-415, provided that the project goes through, would give the commercial airfreight people exactly what they have always said they needed to make airfreight pay: an airplane designed strictly to carry freight. The CL-415 involves no compromises in design for possible passenger conversion or even for military requirements. There is no pressurization for the cabin; no beaver tail; only a square-frame airplane to haul goods. "Give us an aircraft for a tariff of 10¢ a ton-mile" has long been the plaintive cry from George Cussen, The Flying Tiger's articulate chief of sales, and other enthusiastic airfreight boosters. The CL-415 could be it. But the problem, of course, is financing. Are the airlines in a position to raise the money to buy freight planes? And how will a commercial airfreighter stack up in the eyes of Lockheed's management in comparison to the many other projects where the company might use its money?

• **Big contracts**—Soon now, North American Aviation will begin picking its partners in the B-70 project. Ever since NAA won out over Boeing in the competition for the high-performance Air Force bomber, there have been reports that it would farm out a large portion of the work to the Seattle company. This may happen, but it won't be for lack of competition. The B-70 is a big project and a lot of companies would like to get in on a piece of it. Douglas, in particular, is a strong bidder. Another decision NAA will have to make, with Air Force concurrence, is where to build the B-70. Palmdale would seem to be a logical location. They're used to the roar of afterburners at Palmdale, and the B-70, with six General Electric J93s equipped with afterburners, is going to be a noisy brute. On the other hand, NAA could decide to risk a single takeoff from Los Angeles International to the Palmdale airport. Contrary to reports, NAA does have a high bay hangar, which also is wide enough, at its Los Angeles facility.

• **What's this?**—North American in recently organizing a Simulation Council noted that the company's various divisions concurrently were using its simulation and analog equipment for such purposes as engineering investigation of the "design of military and commercial aircraft." Commercial aircraft???

• **Another jet**—Seattle reports say more interest has been shown lately in the on-and-off-again Boeing 727. Boeing still is studying both four-engine and two-engine models. Boeing is inclined to regard the four-engine as more saleable, but the two-engine version makes more sense economically. The airlines will have to make the final decision.

• **Joke**—Mouse emerging from nose cone after landing on moon addresses native: "Take me to your Liederkranz."

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EN ROUTE

Wayne W. Parrish

The Weather Was Lousy, But the People Were Great

There was a time when I had hit every airport served by Allegheny Airlines. Then two new stops were added, Lancaster and Hazleton, Pa., and I've had the devil's own time routing myself through each of these places on the way between Washington and New York.

I knocked off Lancaster on March 14 but only by the grace of determination by Capt. Sheldon Kling to get into Lancaster in the midst of a late-winter snowstorm. He really earned his money that day. The weather was lousy—period.

On an early a.m. flight I went to Harrisburg only to find a low ceiling, a snowstorm, and about six inches on the ground. My flight was late and the eastbound trip was waiting, so an Allegheny agent grabbed my bag and we plowed through snow and slush to the other plane and I piled on board. Off we went and I wondered if we'd ever be able to land at Lancaster.

• **Snow, pretzels and an Amish doll**—But we did, and the snow on the ground was even heavier. An Aero Commander was trying unsuccessfully to get off the ground. A batch of passengers boarded, grateful to be able to leave by air, and D. Griffith, the station manager, dashed on board to present to me a big can of fresh pretzels (best I've ever eaten), an Amish doll and some literature. Lancaster is Amish country, but also famous for pretzels, and known throughout the East as the home of good food.

It was a four-hour trip, Washington-Newark, but worth it. Thanks to Capt. Kling, First Officer Bill Riggle and Flight Agent Bob Egan, for a good flight—and thanks to Lancaster for the loot.

Then on June 12 I tackled Hazleton on another 4-hour flight from Newark to Washington. Ed Lynch, Allegheny's New York manager, cleared the space (which took three segments, two transfers). As far as Williamsport I had Capt. Ken Greenawalt, and my seat companion was ebullient Lucille Wright, of Jamestown, N. Y., who has done as much for aviation as anybody I know; she used to run the Jamestown airport and does a great deal of flying and speech-making.

Just happened that my Hazleton stop was on its first anniversary and the local *Standard-Sentinel* had quite a story on the remarkable traffic record established by Allegheny. No less than 6,400 passengers on and off the first year, 110,000 lbs. of freight, 25,000 lbs. of express and 9,500 lbs. of mail. (Allegheny had forecast only 2,800 passengers the first year.) And of 1,266 scheduled flights, 1,027 were operated, very good considering the terrain and weather conditions of that area.

George Weaver, station manager, gave me an ashtray made out of anthracite coal for which the region is famous, and some literature on the town, courtesy of Clifford L. Jones, executive director of the Greater Hazleton C. of C.

At Williamsport, where I changed planes for Harrisburg, I received a big box of smoked sausage made by John Peters Sons, a famous outfit locally. A lot of pilots pick up sausage at this point and I'm not surprised—it was wonderfully good eating. Thanks to Loren Moss, station manager, for a fine edible gift.

• **Chocolate bars from Hershey**—At Harrisburg I changed planes again for Washington and was met by John Manger, district sales manager, who had a big box of Hershey chocolate bars (they're made nearby at Hershey, Pa.) waiting for me and at the end of four hours I duly arrived in Washington, loaded with loot and having exhausted the last possible remaining new routing between there and New York.

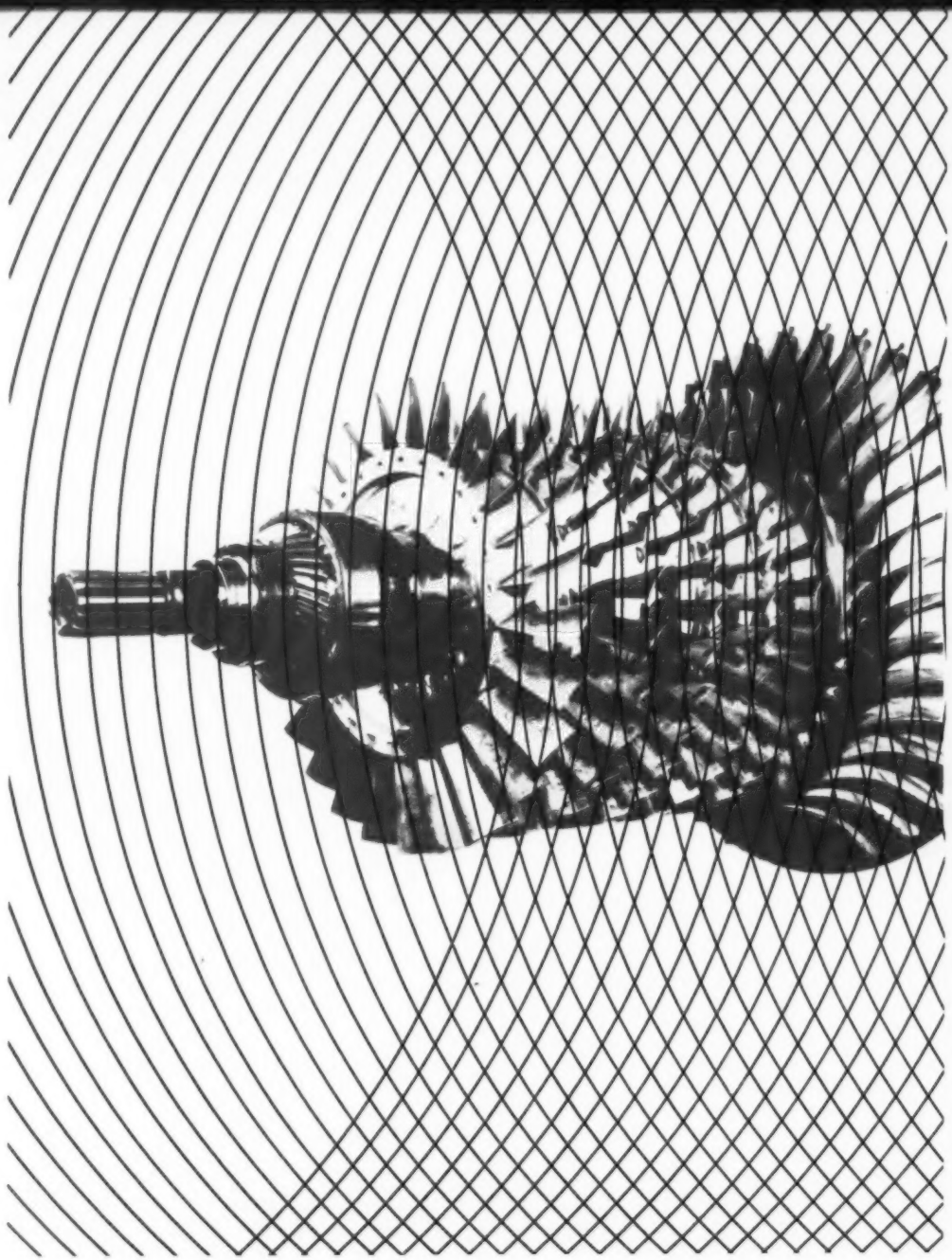
At the moment the only airport served by an airline in all the big state of Texas I've never stopped at is Beeville, and since Trans-Texas has applied to abandon service there maybe I'll win the state by default. Anyway, one of the last stops I made was Pecos, 'way out in the West, and in order to stop there I broke a transcontinental journey at El Paso to take the long local Trans-Texas flight from there to Fort Worth.

Just happened that Jack Howe, assistant to the v. p.-traffic & sales, was in Pecos on company business when I landed there, so I had my mug taken with Dawn Black, a comely stewardess. Pecos has about 8,000 population and is noted for awfully good melons. In a good year they can be altogether as good as those Rocky Fords up in Colorado but back east we don't get many of them because of the long transportation haul and limited supply.

On the same trip that took in Pecos, I routed myself to Houston and joined Earl McKaughan, president of TTA, for a football game in Rice Stadium, stayed the night in the small motel at Houston Airport, and took a very early Eastern local to New Orleans via two new stops, Lafayette-New Iberia, and Lake Charles, La. At New Orleans I was met by my old friend Walt Cutshall, division sales manager for Eastern, and Holt Shipman, d.s.m., and then took a Super-Connie on back to Washington. Not the fastest way from Los Angeles to my home town, but a good one.

HOLT B. SHIPMAN, Eastern's new d.s.m. at New Orleans, greets visitor.

TRANS-TEXAS AIRWAYS' counter at Houston. Earl McKaughan, president, left, WWP and John Eichner, vp-traffic & sales, check schedule.



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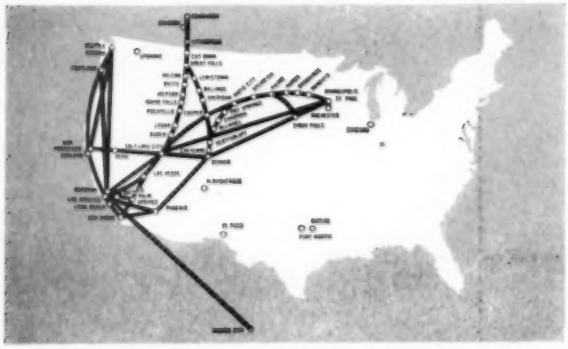

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